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DISEASES *of the* CHEST

VOLUME XII

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NUMBER 1

The Management of Pure Tuberculous and Mixed ^{on} Infection Empyemata*

GEORGE G. ORNSTEIN, M.D., F.C.C.P., and
MYRON HERMAN, M.D., F.C.C.P.
New York, New York

The discussion of management of tuberculous empyema has been troublesome for two reasons: firstly, for the loose definition of "tuberculous empyema," and secondly because the underlying or associated pulmonary tuberculosis chiefly influences the prognosis as to recovery. Inasmuch as judgement of therapy in tuberculous empyema is not made on the effect of the therapy on the empyema *per se*, but on the arrest of the tuberculosis in the lung and pleural cavity, results obtained in therapy vary considerably, and depend both upon the type of tuberculous empyema present and the tuberculous disease in the lung.

In the treatment of tuberculous empyema, when the associated pulmonary tuberculosis is under control, the prognosis is good, whereas in the management of tuberculous empyema with the associated pulmonary tuberculosis not under control, the prognosis is not good, in fact we may say the prognosis is bad. We must therefore know how investigators define tuberculous empyema and classify the associated pulmonary tuberculosis before their results of therapy can be evaluated.

Our first problem is to decide how to define tuberculous empyema. Should the term be restricted to the purulent effusions, when in a period of days a clear pleural exudate may change into a seropurulent fluid and then as rapidly turn into a purulent one? It is because we are not able to determine the definite boundary between a simple tuberculous pleural effusion and a tuberculous empyema that there are so many different definitions of "tuberculous empyema." Woodruff¹ defined tuberculous empyema as any pleural effusion containing tubercle bacilli, whereas Hedblom² restricted the definition to the suppurative pleural ef-

*Department of Medicine, Sea View Hospital, Staten Island, New York.

fusions caused by the tubercle bacilli alone, or complicated by a secondary invasion of other bacterial organisms. Ehler³ took a position between Woodruff and Hedbloom and stated, "Tuberculous empyema should mean serofibrinous, seropurulent and purulent effusions due wholly or in part to the tubercle bacillus and in which tubercle bacilli can be found in smears, cultures and by animal inoculation." Ornstein and Ulmar⁴ suggested that inasmuch as there was such a wide divergence in definition and that changes from clear effusions to purulent effusions may occur rapidly, all tuberculous effusions be defined as tuberculous empyema. The latter investigators further suggested that tuberculous empyemata be classified in a manner similar to the pyogenic empyemata, i.e., into a non-purulent and a purulent group. In the non-purulent tuberculous empyemata, the serous, the serofibrinous and the seropurulent effusions were included. In the purulent tuberculous empyemata, the effusions were purulent, and subdivided on the basis of whether the purulent effusion was due to tubercle bacilli alone or in combination with secondary bacterial invaders. The above definition and classification of tuberculous empyema was adopted at Sea View Hospital and put to a clinical test. It worked fairly well except for a little confusion because of the inclusion of the seropurulent group under non-purulent empyema. This was easily remedied by having three divisions: serous empyema, seropurulent empyema and purulent empyema. We added to the classification information on the presence or absence of tubercle bacilli in the empyema fluid and also information on whether the associated pulmonary tuberculosis was under control or not. By control we meant sputum negative for tubercle bacilli on the concentration test and gastric lavage examination. The uncontrolled cases had sputa positive for tubercle bacilli. The classification further gave information as to the presence of a broncho-pleural fistula, a cutaneous pleural fistula, an empyema necessitatis or tuberculous infection of the thoracic wall.

The classification, as stated previously, divides the tuberculous empyemata into three divisions: A. Non-purulent, B. Seropurulent and C. Purulent. Under each division there are numerals 1, 2, 3, and 4. The odd numbers indicate that the associated pulmonary tuberculosis is under control; and the even numbers, that the associated pulmonary tuberculosis is not under control. The numerals 1 and 2 indicate the pleural fluid is negative for tubercle bacilli and numerals 3 and 4 that tubercle bacilli were demonstrable in the fluid.

In the subdivision of purulent empyema, numerals 5 and 6 were added; the odd and even number again indicate the controlled and the uncontrolled associated pulmonary tuberculosis.

Both numerals indicate mixed infection of tubercle bacilli and secondary bacterial invaders.

The above classification may be visualized in Chart 1.

The evaluation of an empyema is dependent not only on the physical characteristics of the fluid, but also upon what effect this fluid has on the patient. It is a cogent observation that the nature of an empyema in two patients may be almost identical, as to color, consistency, bacterial count and rate of formation; yet one individual will be relatively unaffected, symptomatically, while the other will show marked constitutional symptoms of severe toxemia. There are numerous views postulated to explain this phenomenon, but all are agreed that it is the amount of tuberculo-proteins in the fluid, and the rate at which these are absorbed by the pleural lympho-hematogenous systems, that are principally responsible for the general reaction.

A classification such as above describes all the important details necessary for appraising therapy in tuberculous empyema.

CHART NO. 1

TUBERCULOUS EMPYEMA

A—Non-Purulent:

1. Fluid negative — lung controlled.
2. Fluid negative — lung uncontrolled.
3. Fluid positive — lung controlled.
4. Fluid positive — lung uncontrolled.

B—Seropurulent:

1. Fluid negative — lung controlled.
2. Fluid negative — lung uncontrolled.
3. Fluid positive — lung controlled.
4. Fluid positive — lung uncontrolled.

C—Purulent:

1. Fluid negative — lung controlled.
2. Fluid negative — lung uncontrolled.
3. Fluid positive — lung controlled.
4. Fluid positive — lung uncontrolled.
5. Fluid mixed infection — lung controlled.
6. Fluid mixed infection — lung uncontrolled.

| Color | Appearance | Consistency |
|------------|------------|-------------|
| Amber | Clear | Thin |
| Yellow | Turbid | Thick |
| Brown | Opaque | |
| Sanguinous | | |

Bronchopleural fistula — Cutaneous pleural fistula — empyema
necessitatis — chest wall abscess.

PATHOGENESIS

In this discussion the authors are considering the tuberculous empyemata that frequently complicate pneumothorax therapy for pulmonary tuberculosis. Spontaneous tuberculous empyemata occur but infrequently and are usually associated with extra-pulmonary tuberculosis.

The incidence of tuberculous empyema complicating pneumothorax therapy is high. L. S. Peters⁵ reported 70 per cent occurrence of complicating pleural effusion in 700 pneumothorax cases. Peters did not report these pleural effusions as empyema, for he reported only the purulent fluids as empyema. He found 20 per cent pure tuberculous empyemata and 7 per cent mixed infection. Under our definition all the 70 per cent would be classified as tuberculous empyema.

It is safe to state that 70 per cent or more develop a pleural effusion some time during their pneumothorax therapy. Of these effusions from 10 to 30 per cent become purulent.

The cause and mechanism of pleural effusions have had many explanations and, as in all subjects where there is room for conjecture, there are many theories. These theories include the use of large volumes of gas; maintenance of low pleural pressures; use of high pleural pressures; changes in the season; the injection of cold air into the warm pleural space; the injection of foreign protein material during inflation; the suction effect of the negative pressure on the pleural vessels; the rupture of adhesions; and the constantly increasing opinion that all tuberculous effusions are due to the direct infection of the visceral pleura from the underlying pulmonary tuberculous disease.

The authors favor the latter opinion. Though there may be some evidence that any of the above theories may explain a small incidence of the occurrence of pleural effusion, only direct infection of the pleural cavity can explain the large incidence of tuberculous empyema complicating pneumothorax therapy for pulmonary tuberculosis. For a detailed discussion the reader is referred to articles by Ornstein and Ulmar,⁴ and Ehler.³

As time goes on we cannot help but believe that almost all the tuberculous empyemata are due to direct extension of the tuberculous disease from the visceral pleura and underlying lung tissue. If that is so, there must be a broncho-pleural fistula present in the development of a tuberculous effusion. Fortunately for the patients these broncho-pleural fistulae are very small and closure occurs rapidly. This theory is not a recent one, for the late Pol Coryllos⁶ always associated the occurrence of purulent tuberculous empyema with the presence of a pleuro-pulmonary fistula.

DIAGNOSIS OF BRONCHO-PLEURAL FISTULA

The first step after the diagnosis of a tuberculous empyema is made, is to determine whether or not there is a broncho-pleural fistula present, for its presence precludes any expectant therapy. Once a diagnosis of broncho-pleural fistula is established the treatment is surgical. A thoracotomy should be done, followed very soon by a complete thoracoplasty in stages as the condition of the patient permits. In many instances a Schede operation (unroofing the entire residual empyema cavity by a complete excision of the thoracic wall and greatly thickened parietal pleura) must be done as a final procedure. With surgery, the danger of the contents of the pleural cavity spilling through the fistula into the lung involved and into the other lung is less apt to happen.

It is dangerous to instill dyes or bacterial antiseptics into the pleural cavity in the presence of a broncho-pleural fistula. In large bronchial fistulae the contents of the empyema cavity are frequently expectorated. Patients note the change from the thick consistency of the phlegm to the thin fluid expectorated. Usually the diagnosis can be made by a study of the pleural readings. A change from negative to positive pleural readings is almost pathognomonic of broncho-pleural fistula. Where there is no previous knowledge of the pleural readings, air or fluid may be aspirated from the empyema cavity and if the negative pressure resulting from the aspiration is maintained, one can conclude there is no fistula present.

Another simple test is to instill into the empyema cavity 10 cc. of a sterile one per cent aqueous solution of methylene blue. The patient is gently rolled around so that the dye comes in contact with all pleural surfaces. His expectoration is examined for the dye, for the next two days.

Gas analysis is an important diagnostic method for broncho-pleural fistula. This test requires well trained technicians; who are only available in large medical centers. The gas analysis in the average pneumothorax complicated by an effusion reveals about 14 per cent CO_2 and 0.15 per cent O_2 . Experience has shown that when the CO_2 percentage goes below 9 per cent and the O_2 percentage rises above 1 per cent a diagnosis of broncho-pleural fistula can be made. Matsuzawa⁸ has shown that in mixed infection empyema when the CO_2 rises above 14 per cent, broncho-pleural fistula should be suspected. Matsuzawa found that the intrapleural pressure readings, the dye test and the gas analysis give about 60 per cent positive tests and the percentage of diagnosis is greatly enhanced by using all the above tests.

PLAN OF TREATMENT

To reiterate briefly, the presence of a broncho-pleural fistula is an emergency surgical problem. The salvation of a patient in this circumstance lies in the prompt introduction of a thoracotomy tube to drain the empyema space, followed shortly thereafter by a complete thoracoplasty and an additional Schede operation, where indicated.

All other cases of pure tuberculous and mixed infection empyema, where there is no broncho-pleural fistula, deserve preliminary non-surgical treatment. However, the final disposition of a case, i.e., concerning the reexpansion of the lung and possible surgical intervention, is dependent upon the status of the disease in the underlying lung. It is therefore indispensable, in the correct management of any empyema, to know whether or not the lung is controlled.

The indications for therapy in these groups of tuberculous empyema without broncho-pleural fistula are categorized as follows:

A. Controlled Lung.

1. The ideal end result is the reexpansion of the lung and the obliteration of the empyema cavity. This serves to remove the danger of perforation of the empyema into the lung with the formation of a broncho-pleural fistula.

2. It also does away with the possibility of extension of pus into the soft tissues of the chest wall, with the development of an empyema necessitatis, draining sinuses and abscesses. Case 1 is indicative of the above.

3. The reexpansion of the lung, furthermore, restores good lung tissue to some degree of breathing function and improves the vital capacity. This point is well demonstrated in Case 2.

4. At times, lungs fail to reexpand because of atelectasis, obstruction of the major bronchi, pulmonary fibrosis and a constricting thickened pleura enveloping the lung. In these instances, the purpose of treatment is to prevent re-formation of the fluid or to change its consistency into thin serous fluid with few or no bacilli. This fluid, so altered, is rendered relatively innocuous and may in time become completely absorbed or encapsulated.

B. Uncontrolled Lungs.

1. The paramount purpose in these cases is to rid the patient of the empyema by removing the fluid and reexpanding the lung. By so doing a simple thoracoplasty now suffices for the treatment of the lung whereas otherwise an extensive Schede (pleurectomy) would have been necessary to obliterate the pleural space. Case 3 admirably illustrates this point.

2. The absence of fluid permits a better technical thoracoplastic result and therefore a correspondingly higher number of apparent cures.

3. Complicating chest wall abscesses, sinuses and especially empyema necessitatis, are indications for expansion of the lung. By obliterating the pleural space the pleurae generally become adherent, the sinuses close spontaneously and the abscesses regress. In a number of empyema necessitatis cases, the negative or subatmospheric pressure induced to reexpand the lung, has sucked back the pus from the necessitatis pocket in the chest wall into the pleural space. Subsequent reexpansion of the lung and symphysis of the visceral and parietal pleurae cause a disappearance of this morbid condition. Case 4 is an example of the above.

4. Where continued pneumothorax is desirable for closure of pulmonary cavities, it is essential to change the character of the empyema fluid so that the danger of chest wall infection is minimized.

5. Severe toxemia is another important indication for active treatment. It has the added advantage of improving the general condition of the patient thus making him a better surgical risk where intervention is deemed necessary.

METHOD OF NON-SURGICAL THERAPY

The numerous and varied antiseptics used in the past for irrigation and lavage were found to be rather unsatisfactory and the results were correspondingly poor. The more popular agents utilized were gentian violet, crystal violet, Dakin's solution, methylene blue, gomenol, saline, grain alcohol, optochin, sodium taurocholate and dilute solutions of iodine and acriflavine.

In recent years Petroff and Schain⁹ experimented with detergent solutions in combination with antiseptics and found that the bactericidal properties of the latter were noticeably improved. The most satisfactory solution, used at first, consisted of azochloramide 1:2000 and triethanolamine or sodium tetradecyl sulfate 1:800. This was given a rather extensive clinical trial by Palitz and Herman¹⁰ and Petroff, Herman and Palitz.¹¹ The results were very satisfactory but the combined drug was found to be irritating to some patients. Petroff¹² therefore, subsequently, prepared a solution containing a mercurial compound and sodium tetradecyl sulfate, which is being used exclusively at present. The effect of this substance is more bactericidal in laboratory and guinea pig experiments and much less irritating.

We are reporting a series of ninety-eight cases whom we were able to follow for periods varying from nine months to five years,

with an average time of 30 months ($2\frac{1}{2}$ years). Each case had either a frankly purulent tuberculous or mixed infection empyema. In addition every patient showed further manifestations such as toxemia, chest wall abscess, etc., or there was a clear-cut indication for therapy, as already stated above.

When a patient was chosen for treatment, his chest was first aspirated dry or as nearly dry as possible. Four ounces of the detergent solution were instilled into the pleural space and permitted to remain until the next day. Again an aspiration was performed, and at the end four ounces of solution were injected and left until the third day when a similar procedure was followed.

After this, irrigations were carried out twice weekly until the desired result was achieved or until the plan of treatment was changed.

"Oxygen lavage" was used in conjunction with this treatment to cause reexpansion of lungs where indicated. This procedure, introduced by Welkind and Herman,^{13,14} consists of putting oxygen into the pleural space of the collapsed lung. The rapid absorption of the oxygen from the pleural space with the creation of a highly negative pressure causes quick physiological expansion of the lung.

The patient is first fluoroscoped and the extent of the pneumothorax space is ascertained. The patient is then placed in the lateral prone position. One needle, gauge 18, is inserted into the upper pole of the pneumothorax space and is connected with a deflation apparatus. The second needle is placed into the lower portion of the space and is used as the oxygen inlet. Midway between the needle and the tank supplying the pure oxygen, is a deflation bottle half-filled with water and closed with a 2-hole rubber stopper. Protruding through one opening is a long glass tube which extends below the level of the water. The free end is attached to the oxygen tank by rubber tubing. The other opening in the rubber stopper is sealed by another hollow glass tube which remains above the level of the water and is connected by rubber tubing and a special adaptor to the needle in the chest wall.

When the valve of the tank is opened, oxygen flows to the deflation bottle and bubbles through the water, flows out through the other tube and passes into the thoracic cavity. Simultaneously the deflation machine is put into operation and gas from the pleural cavity is aspirated while oxygen is concurrently being instilled. This procedure is continued for a period of about twenty-five minutes. (Gas analysis shows about 90-95 per cent saturation at the end of this time.) Occasional readings are taken throughout, with the purpose of maintaining pressures with a mean of zero. Simple manipulation of the oxygen valve on the tank will control the rapidity of inflow.

At the end of the time specified, the oxygen is stopped and the needle is removed. A final reading of about -8 to 0 is obtained (this was found to be most comfortable for the patient) and the second needle is then withdrawn.

Depending upon the purpose for which this procedure was instituted, the lung is either permitted to attain full reexpansion, or this is prevented at any stage by refills.

Zweighaft¹⁵ has recently perfected a modification of this method by inserting a safety valve in the system, thus preventing any undue increase of pressure in the pleural space.

CASE REPORTS

Case 1: W. M., a 28 year old white male, had had bilateral pneumothorax for caseous pneumonic disease with cavitation in both lungs. Definite evidence of a bronchopleural fistula developed on the right but soon closed spontaneously. An empyema formed and the fluid was thick, yellow and purulent; the tubercle bacilli count was Gaffky IV. By the time the patient was presented for treatment, the empyema had been present for one year. Under treatment with the detergent solution the fluid became thinner and much less in amount. Oxygen lavage was used to reexpand the lung. The empyema space was obliterated. The patient has now been observed for a period of five years and feels perfectly well (Figs. I, II, III).

Case 2: C. J., a 23 year old colored male had a right pneumothorax for large cavities in the upper lobe. Adhesions prevented the closure of the cavities and an apicolysis (Jacobeus) operation was performed. This was followed shortly thereafter by a total collapse of the lung with high positive pressures, a marked mediastinal shift and dyspnea on bed rest. A purulent empyema formed rapidly. This was thick, creamy yellow pus and further aggravated the patient's dyspnea. With detergent solutions, the fluid entirely disappeared and the lung was rapidly re-expanded with oxygen lavage. The vital capacity improved tremendously and the breathing reserve became six times greater than the resting minute ventilation. The patient has been able to carry on the functions of every day life with no discomfort (Figs. IV, V, VI).

Case 3: L. S. was a 21 year old negro truck driver who developed a large empyema following a Jacobeus operation in the left pleural space. In view of a persistently positive sputum coming from the left lung, a thoracoplasty operation was indicated. However, before this could be done the empyema space first had to be obliterated. With intensive irrigations of detergent solutions the fluid thinned appreciably and did not reform. Seven oxygen lavages were required to reexpand the lung.

A six-rib thoracoplasty, in two stages, was then performed, the cavity closed and the sputum became negative for the tubercle bacillus. Had the empyema not been first eradicated, a preliminary thoracostomy would have been necessary, followed by an eleven-rib thoracoplasty and finally by an extensive Schede operation (Figs. VII, VIII, IX, X).

Case 4: F. V., a 40 year old housewife, had a right pneumothorax in 1938 for cavities in the upper lobe. A broncho-pleural fistula developed



Figure I

Figure II

Figure III

Fig. I, Case 1: Massive purulent empyema of one year duration which developed as result of a small transient broncho-pleural fistula during the course of pneumothorax therapy. The plan of treatment is to thin out the thick empyema fluid with detergent solutions and to reexpand the lung with oxygen lavage.—*Fig. II, Case 1:* Under treatment the thick, purulent fluid has become watery in consistency and does not re-form. In spite of a thick overlying visceral pleura the lung has expanded appreciably.—*Fig. III, Case 1:* The ideal end result of treatment: the fluid has entirely disappeared, the lung is completely reexpanded. The sputum is negative for the tubercle bacilli and the patient feels excellent. (Five years observation).

shortly thereafter and an empyema formed. The fistula apparently sealed over but the empyema remained. The patient refused any type of treatment for the empyema and signed out of the hospital. She returned two years later with a massive intrapleural empyema and a tremendous empyema necessitatis over the right chest wall about the size of a grapefruit. The pus in the empyema space as well as in the necessitatis pocket was so thick that it could not be aspirated through a gauge No. 18 needle. With the use of detergent solutions the fluid became much thinner so that in a few days no further difficulty was encountered with chest aspirations. An oxygen lavage was performed and the resulting negative (subatmospheric) pressure sucked the pus from the necessitatis pocket into the intrapleural empyema space which was then tapped. The lung completely reexpanded and the empyema necessitatis disappeared. The patient has been observed for three and one-half years and feels excellent (Figs. XI, XII, XIII).

The results of non-surgical therapy can be seen in the appended charts 2 to 8.

CHART 2

PURULENT 1

Purulent Fluid Negative for Tubercle Bacilli.
Lung Disease Under Control.

Complete Reexpansion

| <i>Case</i> | <i>Observation after reexpansion</i> | <i>Died</i> | <i>Remarks</i> |
|-------------|--|-------------|--|
| 1. F. G. | 2 years | + | Post-operative death following oophorectomy. |
| 2. A. L. | 2 yrs. 6 mo. | | |
| 3. L. H. | 2 years | | |
| 4. H. J. | 4 yrs. 6 mo. | | |
| 5. A. K. | 1 yr. 8 mo. | | |
| 6. C. J. | 4 yrs. 4 mo. | | |

Lung Reexpansion with Encapsulation of Fluid

| | | | |
|----------|-----------|--|--|
| 7. J. A. | 11 months | | Almost complete reexpansion with small axillary encapsulation. |
|----------|-----------|--|--|

Process of Expansion

| | | | |
|----------|--|---|--|
| 8. C. F. | | + | Died of hematogenous infection after therapy was started. Tuberculosis of testes and meninges. |
|----------|--|---|--|



Figure IV

Figure V

Figure VI

Fig. IV, Case 2: A Jacobaeus (apicolysis) operation was performed to sever adhesions keeping an upper lobe cavity patent. Following this procedure a broncho-pleural fistula developed and an empyema soon formed. The patient was dyspneic even on bed rest (See Figs. V and VI).—Fig. V, Case 2: The empyema on the right has increased in amount since the previous x-ray (Fig. IV), and is thick and creamy in consistency. The broncho-pleural fistula has apparently healed. Dyspnea on bed rest is still present. The rationale of treatment with detergents and oxygen lavage is to thin out the fluid and reexpand the lung, thus providing a greater vital capacity.—Fig. VI, Case 2: Under treatment the desired end result was achieved. The fluid was thinned out appreciably and did not re-form. The lung reexpanded and the patient's breathing reserve increased six times that above his resting minute ventilation, allowing him to perform the duties of every day life without any respiratory discomfort.

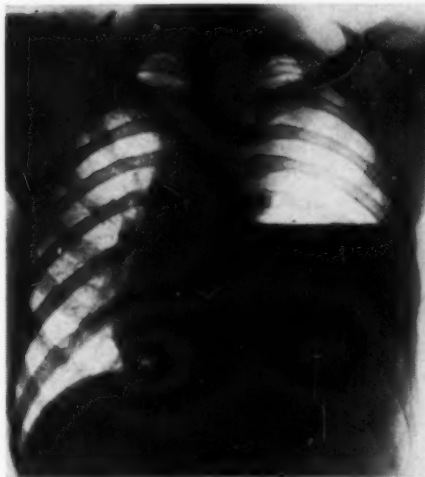
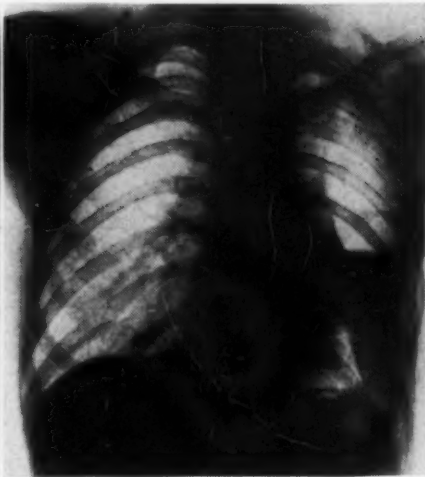
*Figure VII**Figure VIII*

Fig. VII, Case 3: Empyema which developed after a Jacobeus operation. Cavity in lung remained open. Thoracoplasty was indicated for the uncontrolled pulmonary lesion. Treatment of the empyema with detergent solutions and the reexpansion of the lung with oxygen lavage were undertaken at this time. Without first obliterating the empyema space, thoracostomy followed by a Schede operation would have been necessary. (See Figs. VIII, IX and X). —*Fig. VIII, Case 3:* Under treatment with detergent solution and oxygen lavage considerable reexpansion of the lung has taken place since the previous roentgenogram (Fig. VII). The fluid is much decreased in amount and is serous in nature.

*Figure IX**Figure X*

Fig. IX, Case 3: With the use of detergent solution and oxygen lavage the lung has been completely reexpanded. The cavity in the left upper lobe is well visualized. Now a thoracoplasty operation can be done.—*Fig. X, Case 3:* A two stage thoracoplasty has been performed and the sputum has become negative for tubercle bacilli. No cavity is seen. The patient has thus been spared the shocking radical and serious Schede operation as well as a more extensive thoracoplastic procedure.

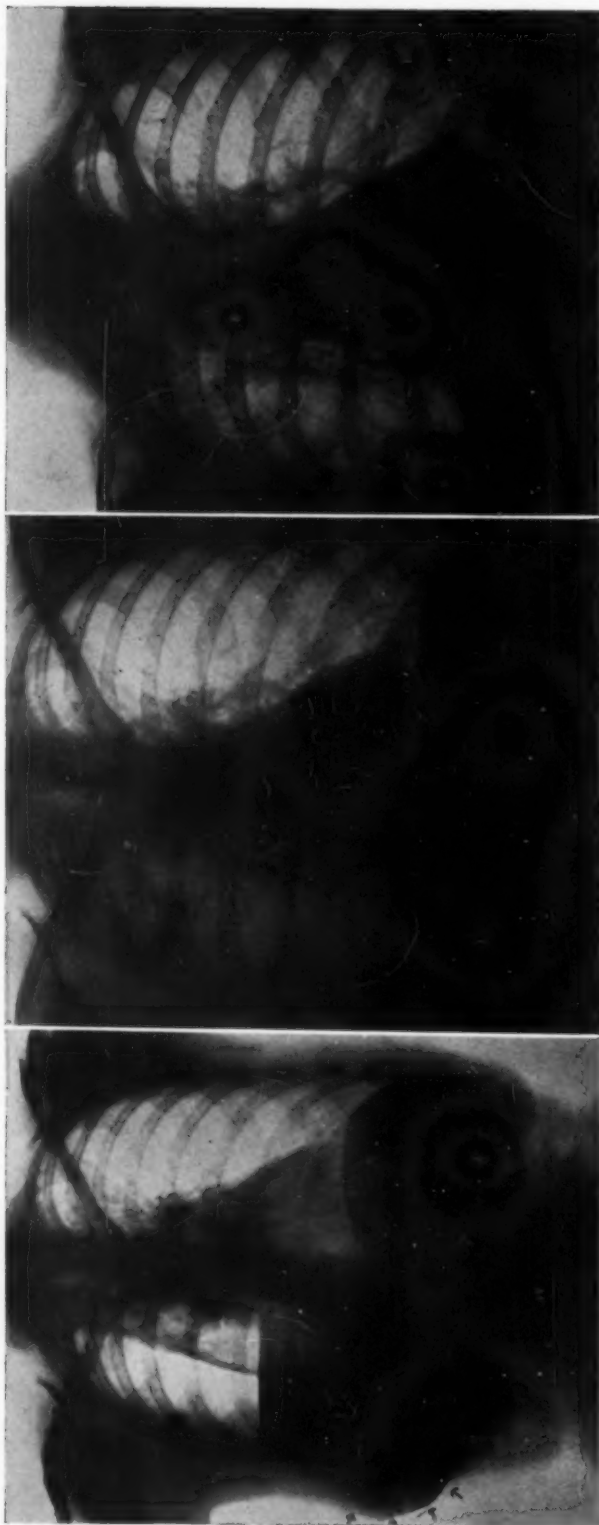


Figure XI

Figure XII

Figure XIII

Fig. XI, Case 4: F. V., a 40 year old housewife developed a right empyema in the course of pneumothorax therapy. The patient refused any treatment and signed out of the hospital. She returned two years later with a large intrapleural empyema as well as an empyema necessitatis. The plan of treatment was to aspirate the intrapleural pus and thin it with detergent solution, then reexpand the lung with oxygen lavage. The resulting negative pressure, would, it was hoped, suck the pus in the necessitatis pocket into the pleural space. The subsequent symphysis of the visceral and parietal pleura would permanently cure the intrapleural empyema as well as the empyema necessitatis. Note the large empyema necessitatis demarcated by arrows (See Figs. XII and XIII).—**Fig. XII, Case 4:** The empyema necessitatis has disappeared. The previous thick intrapleural pus has been rendered very thin and serous by detergent solution and the lung has reexpanded appreciably.—**Fig. XIII, Case 4:** An ideal end result through treatment with detergent solution and oxygen lavage. The empyemata (intrapleural and necessitatis) have disappeared and the lung has completely reexpanded. The sputum is negative for the tubercle bacillus, no cavities are present.

CHART 3—PURULENT 3

| Purulent Fluid Positive for Tubercle Bacilli. Lung Disease under Control. | | | | |
|---|-------------------------|-----------------------|----------------------------------|---|
| Complete Reexpansion | | | | |
| Case | Empyema Necessitatis | Chest Wall Abscess | Observation after reexpansion | Died |
| 1. A. Y. | | | 2 years | |
| 2. W. C. | | | 2 yrs. 6 mo. | |
| 3. D. C. | | | 10 months | |
| 4. F. V. | + | | 3 years | Large empyema necessitatis disappeared. |
| 5. S. G. | | + | 4 years | Abscess disappeared. |
| 6. L. B. | + | + | 2 yrs. 6 mo. | Empyema necessitatis and chest wall abscess healed. |
| 7. J. F. | | | 4 years | |
| 8. P. H. | | | 3 yrs. 9 mo. | |
| 9. A. H. | | | 2 yrs. 6 mo. | + |
| 10. V. J. | | | 1 yr. 6 mo. | Respiratory and cardiac failure. |
| 11. L. W. | | | 1 year | |
| 12. F. N. | + | | 3 yrs. 6 mo. | Empyema necessitatis healed. |
| 13. D. T. | | + | 2 yrs. 10 mo. | 4-stage thoracoplasty at another hospital for empyema. Chest wall abscess healed. |
| 14. V. S. | | | 9 months | |
| 15. T. P. | | | 1 year | |
| 16. A. H. | + | | 1 yr. 6 mo. | + |
| 17. D. C. | | + | 3 yrs. 4 mo. | Killed in auto accident. Chest wall abscess disappeared. |

CHART 4—PURULENT 3
 Purulent Fluid Positive for Tubercle Bacilli. Lung Disease under Control.
Lung Reexpansion with Encapsulation of Fluid.

| Case | Empyema Necessitatis | Chest Wall Abscess | Broncho- pleural Fistula | Observation after Reexpansion | Died | Remarks |
|----------|-------------------------|-----------------------|--------------------------------|----------------------------------|------|---|
| 1. V.P. | | + | + | | + | Developed broncho-pleural fistula and drowned in fluid. |
| 2. J.C. | | + | | 2 years | | Small encapsulated pocket. Chest wall abscess cleared. |
| 3. P.H. | | + | | 3 years | | Lung expanded 50%. Thin fluid. |
| 4. J.H. | | + | | 2 yrs. 7 mo. | | Lung did not reexpand. Fluid sero-purulent. |
| 5. N.B. | | | | 2 yrs. 6 mo. | | Small encapsulation. |
| 6. F.R. | + | + | | 1 year | | Empyema necessitatis disappeared. Chest wall abscess healed. Small encapsulation. |
| 7. W.D. | + | + | | 9 months | | Amyloid disease. |
| 8. C.G. | | | | 3 yrs. 8 mo. | | Small encapsulation. |
| 9. R.H. | | | | 3 years | | Practically no reexpansion. |
| 10. J.I. | + | | | 3 years | | Empyema necessitatis surgically drained, healed; 75% expansion. |
| 11. H.M. | | | | 1 yr. 8 mo. | | Lung expanded 50%. |
| 12. D.P. | | | + | | + | Lung almost reexpanded. Developed broncho-pleural fistula. Drowned in fluid. |
| 13. N.V. | | | | 3 years | | Small encapsulation. |
| 14. E.T. | | | | 2 years | | No reexpansion. |
| 15. A.M. | | | | 5 years | | Small encapsulation. |
| 16. J.M. | | + | | 2 years | | Chest wall abscess healed. |
| 17. J.R. | | | | 2 yrs. 5 mo. | | Expanded 90%. Encapsulation of fluid. |
| 18. H.M. | | | | 2 yrs. 6 mo. | | Expanded 75%. Encapsulation of fluid. |

CHART 5

PURULENT 3

Purulent Fluid Positive for Tubercle Bacilli.
Lung Disease Under Control.

Incomplete Reexpansion and no Encapsulation.

| Case | Empyema necessitatis | Chest Wall Abscess | Died | Remarks |
|---------|-------------------------|-----------------------|------|---|
| 1. D.T. | | + | + | Abscess broke down—developed mixed infection. Turned over to surgery. Thoracostomy, thoracoplasty, Schede—Died. |
| 2. Y.P. | | | | Unable to reexpand lung after one year. Slow increase in pleural fluid. Still has hydropneumothorax after one year. |
| 3. M.R. | | | + | In the course of therapy patient developed broncho-pleural fistula and referred to surgery. Thoracostomy, thoracoplasty & Schede were done. She died of complicating pneumonia. |
| 4. W.D. | | + | + | Died of amyloid disease. |

CHART 6

PURULENT 4

Purulent Fluid Positive for Tubercle Bacilli.
Lung Disease Uncontrolled.

Complete Reexpansion of Lung — No. of Cases = 21

| Referred to Surgery | Bilateral Tuberculosis Surgery impossible | Spontaneous cure | Refused surgery | Deaths |
|---|--|---------------------|--------------------|--------|
| 5 | 6 (4 deaths) | 4 | 6 (2 deaths) | 6 |
| <i>Lung Reexpansion with Encapsulation of Fluid — No. of Cases = 14</i> | | | | |
| 3 (1 death) | 4 (3 deaths) | 4 | 3 (3 deaths) | 7 |
| <i>Incomplete Reexpansion and no Encapsulation — No. of Cases = 5</i> | | | | |
| 2 (1 death) | 1 (1 death) | | 2 (1 death) | 3 |

CHART 7—PURULENT 5

Mixed Infection (Purulent fluid positive for Tubercle Bacilli and Pyogens). Lung Disease Controlled.

Complete Reexpansion

| Case | Empyema Necessitatis | Chest Wall abscess | Broncho- pleural fistula | Observation after reexpansion | Died | Remarks |
|----------|-------------------------|-----------------------|--------------------------------|----------------------------------|------|--|
| 1. T. W. | | + | | 3 years | | Thoracotomy tube in pleural space for 2 yrs. Organisms Tbc., Strep., pyocyanous. Sinus closed, lung reexpanded 98%. Small layer of thin fluid or thickened pleura. |
| 2. M. C. | | | | 2 years | | Lung completely reexpanded. |

Lung Reexpansion with Encapsulation of Fluid

| | | | | | | |
|----------|--|---|--|---------|--|--|
| 3. M. G. | | | | 3 years | | Lung almost completely reexpanded. |
| 4. F. S. | | + | | 2 years | | Thoracotomy done elsewhere. Sinus closed completely. Lung out 80%. |
| 5. C. M. | | + | | 2 years | | Infection of breast as well as 2 sinuses healed. Thoracotomy sinus closed. Fluid small and encapsulated. |

Process of Expansion

| | | | | | | |
|----------|--|--|--|--|---|---|
| 6. A. P. | | | | | + | Died of meningitis after treatment was started. |
|----------|--|--|--|--|---|---|

CHART 3 — PURULENT 6

Mixed Infection (Purulent fluid positive for Tubercle Bacilli and Pyogens). Lung Disease Uncontrolled.

Complete Reexpansion

| Case | Empyema Necessitatis | Chest Wall abscess | Broncho- pleural fistula | Observation after reexpansion | Died | Remarks |
|------|-------------------------|-----------------------|--------------------------------|----------------------------------|------|---------|
|------|-------------------------|-----------------------|--------------------------------|----------------------------------|------|---------|

| | | | | | | |
|----------|--|--|--|---------|--|--------------------------------|
| 1. A. L. | | | | 3 years | | Cavities closed spontaneously. |
|----------|--|--|--|---------|--|--------------------------------|

| | | | | | | |
|----------|--|--|--|---------|--|--|
| 2. P. C. | | | | 2 years | | |
|----------|--|--|--|---------|--|--|

Lung Reexpansion with Encapsulation of Fluid

| | | | | | | |
|----------|--|--|--|---------|--|---|
| 3. A. S. | | | | 3 years | | Lung expanded 80%. Small localized pocket of fluid. |
|----------|--|--|--|---------|--|---|

| | | | | | | |
|----------|--|--|--|-------------|--|--|
| 4. J. D. | | | | 1 yr. 2 mo. | | Patient refuses surgery for lung lesion. |
|----------|--|--|--|-------------|--|--|

Process of Expansion

| | | | | | | |
|----------|--|--|---|--|---|---|
| 5. J. G. | | | + | | + | Bronchopleural fistula opened. Thoracostomy done. Patient died. |
|----------|--|--|---|--|---|---|

| | | | | | | |
|----------|--|--|---|--|---|---|
| 6. J. S. | | | + | | + | Oleothorax elsewhere with empyema necessitatis and mixed infection empyema. Broncho-pleural fistula opened during treatment. Patient refused surgery. Died. |
|----------|--|--|---|--|---|---|

DISCUSSION

The efficacy of treatment in pure tuberculous and mixed infection empyemata is largely dependent upon the status of the disease in the underlying lung. The reduction of toxemia, the reexpansion of lungs, and the healing of chest wall infections are all very important during the course of therapy, but the vital consideration is, *what ultimately happens to the patient?* The empyema must be thought of as a local suppurative process in the pleural space complicating a chronic infection of the lung. The treatment of each of these conditions therefore is inextricably associated with the other. It avails us very little to cure an empyema and have a dead patient as a result of progressive pulmonary tuberculosis.

The importance of the lung condition is well borne out by a comparison of the mortality statistics in Groups Purulent 3 and 4. In both groups the physical nature of the fluid is similar and both fluids contain the tubercle bacilli. The only difference is that in Purulent 3, the lung is controlled whereas in Purulent 4 the lung is uncontrolled. The percentage of deaths is 15 per cent and 40 per cent respectively.

Emphasis is further drawn to the determining role of the lung when Group Purulent 1 (lung controlled, fluid negative for the tubercle bacilli) is studied. One death occurred making the rate 16.5 per cent—a considerable difference from the 40 per cent in uncontrolled cases.

The controlled lung groups Purulent 1 and 3 of pure tuberculous empyema showed a combined mortality rate of 17 per cent.

No definite conclusions can be drawn from an analysis of the mixed infection cases since the number in this series is too small (12 cases). However the figures are interesting since here again the lung controlled group showed a 16.6 per cent mortality as compared to 33 per cent in the uncontrolled group.

The effects of treatment on the fluid were striking. The pus was thinned after the first few irrigations, but several more weeks of vigorous therapy were required to render the fluid permanently thin. The bacterial count in the fluid was reduced in number in most instances but relatively few showed a complete disappearance of organisms. Apparently, also, the virulence of the tubercle bacilli was lowered since the number of chest wall infections, (abscesses, nodules and sinuses), was reduced to a negligible amount. Prior to the present treatment, during the course of aspirations, the chest wall was involved sooner or later in 25 per cent of all empyemata.

The action on the toxemia and temperature of the patient was

extremely gratifying. In some cases the drop in fever occurred dramatically after the first few irrigations and was lasting. With disappearance of the toxic manifestations, the patients ate better, gained weight rapidly and experienced a state of general well being.

In 48 cases of this series, the empyema fluid disappeared and the lung completely reexpanded. In only one instance was there a recurrence of the empyema. This resulted because of a spontaneous pneumothorax. With intensive treatment, the lung again fully reexpanded. The patient was further observed for two years and is apparently cured.

Of 28 cases which fall into the category "Lung reexpansion with encapsulation of fluid," most have small loculated pockets of thin fluid and a lung appreciably expanded. Undoubtedly, a significant number of these in the future will go on to re-absorb the thin fluid and completely reexpand the lung thus augmenting the 48 cases described above.

We have repeatedly stressed the fatal nature of a persistent broncho-pleural fistula with a pure tuberculous or mixed infection empyema and the fact that surgical intervention is indicated in these cases. The accomplishments of surgery can be seen in the analysis of 86 cases of empyema with broncho-pleural fistula which were operated upon over a period of time roughly corresponding to that during which we were treating our non-surgical group reported in this paper.

All 86 cases had a thoracostomy and thoracoplasty and 56 of these also had a Schede operation. The results were as follows:¹⁶

| | |
|------------------|-------|
| Cured | 34 % |
| Unimproved | 19.5% |
| Deaths | 46.5% |

Any case saved in this group is a distinct achievement.

SUMMARY

1. Ninety-eight cases of frankly purulent tuberculous or mixed infection empyemas are categorized according to the Ornstein classification (discussed in the text). This division takes cognizance of the physical aspect of the pus—color and consistency, the organisms present therein, the condition of the underlying lung, whether controlled (sputum negative for the tubercle bacillus) or uncontrolled (sputum positive for the tubercle bacilli), the presence of chest wall infections (abscesses, sinuses, empyema necessitatis), and finally what constitutional effects the empyema has upon the patient.

2. In every instance the plan of treatment was determined by

the condition of the underlying lung—whether controlled or uncontrolled. The aims to be accomplished in these two groups without broncho-pleural fistulae were as follows:

A. Controlled Lung:

1. Completely reexpand the lung and obliterate the pleural cavity thus removing a source of infection.
2. This also prevents the subsequent formation of empyema necessitatis as well as other chest wall infections.
3. Reexpansion restores good functioning lung tissue thereby increasing the vital capacity.
4. In certain cases where the lung fails to reexpand because of atelectasis, obstruction of the major bronchi, pulmonary fibrosis and a constricting thickened pleura enveloping the lung, the purpose of treatment is to prevent the re-formation of pus or change its consistency into thin serous fluid thus rendering it relatively innocuous.

B. Uncontrolled Lungs:

1. Reexpand the lung and obliterate the pleural cavity. In this way a simple thoracoplasty suffices for the treatment of the lung obviating the need for the shocking and radical Schede operation which would have been necessary otherwise.
2. The removal of the fluid and reexpansion of the lung also permits a better thoracoplastic result and a higher number of apparent cures.
3. Symphysis of the visceral and parietal pleura with obliteration of the empyema cavity results in a rapid clearing of chest wall infections which developed because of the original empyema.
4. Where continued pneumothorax is necessary for closure of pulmonary cavities, the rationale of therapy is to alter the empyema fluid so that the danger of chest wall infection is minimized.
5. In instances of severe toxemia treatment is indicated. The constitutional improvement makes the patient a better surgical risk, where operation is warranted.

3. The results under treatment with detergent solutions were dramatic and gratifying. The pus was thinned after the first few irrigations, the bacterial count was lowered and the virulence of the tubercle bacilli was reduced. Chest wall infections became a negligible factor; the temperature became normal and the general well being of the patient was soon manifest. A large number of

lungs were reexpanded completely with oxygen lavage and the empyema cavity obliterated (48 cases).

4. The presence of a broncho-pleural fistula is a grave danger to the life of the individual and must always be considered a surgical problem. Eighty-six cases operated upon over a period corresponding with that during which we were treating our non-surgical group showed the following results:

| | |
|------------------|-------|
| Cured | 34 % |
| Unimproved | 19.5% |
| Deaths | 46.5% |

RESUMEN

1. Se divide en categorías 98 casos de empiemas francamente purulentos, tuberculosos o de infección mixta, de acuerdo con la clasificación de Ornstein (discutida en el texto). En esta división se toman en cuenta el aspecto físico (color y consistencia) del pus y las bacterias que contiene, la condición del pulmón subyacente, si cohibido (esputo negativo para el bacilo de Koch) o no cohibido (esputo positivo para el bacilo de Koch), la presencia de infecciones de la pared torácica (abscesos, fistulas, empiema de necesidad) y, finalmente, qué efectos orgánicos causa el empiema al paciente.

2. La condición del pulmón subyacente—si cohibido o no—fue lo que determinó en cada caso el régimen terapéutico empleado. En estos dos grupos sin fistulas broncopleurales se intentó llevar a cabo lo siguiente:

A. *Pulmones Cohibidos:*

1. Efectuar la reexpansión total del pulmón y la obliteración de la cavidad pleural, eliminando así una fuente de infección.
2. Con esto también se evita la aparición subsecuente de empiema de necesidad, así como de otras infecciones de la pared torácica.
3. La reexpansión restituye tejido pulmonar en buen estado funcional, aumentando así la capacidad vital.
4. En ciertos casos en los que no se puede llevar a cabo la reexpansión del pulmón debido a atelectasia, obstrucción de los grandes bronquios, fibrosis pulmonar o a que el pulmón está envuelto en una pleura engrosada que causa constricción, el propósito del tratamiento es evitar la re-formación del pus o alterar su consistencia a la de un derrame fluido, volviéndolo así relativamente inocuo.

B. Pulmones No Cohibidos:

1. Efectuar la reexpansión del pulmón y la obliteración de la cavidad pleural. De esta manera basta una toracoplastia sencilla para el tratamiento del pulmón, evitando así la operación grave y radical de Schede que de otro modo habría sido necesaria.
 2. La eliminación del derrame y la reexpansión del pulmón también permiten obtener un mejor resultado con la toracoplastia y un número mayor de curaciones aparentes.
 3. La sínfisis de las hojas visceral y parietal de la pleura, con la obliteración de la cavidad del empiema, tiene por resultado la rápida cicatrización de las infecciones de la pared torácica que sobrevinieron a causa del empiema original.
 4. Cuando es necesario continuar el neumotórax para cerrar cavernas pulmonares, el objeto del tratamiento es alterar el derrame para reducir al mínimo el riesgo de infección de la pared torácica.
 5. En los casos de toxemia grave está indicado el tratamiento; la mejoría general hace del enfermo un mejor riesgo quirúrgico cuando el caso es operable.
3. Los resultados terapéuticos obtenidos con soluciones detorsorias fueron espectaculares y satisfactorios. Se fluidificó el pus después de las primeras pocas irrigaciones, disminuyeron las bacterias y se redujo la virulencia de los bacilos tuberculosos. Las infecciones de la pared torácica se convirtieron en un factor insignificante; se normalizó la temperatura y se puso pronto de manifiesto el bienestar general del enfermo. Se llevó a cabo la reexpansión total de un gran número de pulmones mediante lavados con oxígeno y se obliteró la cavidad del empiema (48 casos).
4. La presencia de una fístula broncopleurale constituye un grave peligro para la vida del paciente y debe ser considerada siempre un problema quirúrgico. Ochenta y seis casos fueron sometidos a operación en un período correspondiente a aquel durante el cual tratamos a nuestros casos no quirúrgicos, con los siguientes resultados:

| | |
|--------------------|-------|
| Curados | 34.0% |
| No mejorados | 19.5% |
| Fallecidos | 46.5% |

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Chronic Pleural Empyema* (Its Surgical Treatment)

JOHN B. GROW, M.D., F.C.C.P.
Denver, Colorado

Writing in 1916, at which time chronic empyema was much more common than it is at the present, Robinson¹⁷ described the condition as the "Patriarch of the Surgical Scrapheap". He pictured the typical patient as "A stooping, one-sided, emaciated, pale, club fingered individual—not seriously ill, but nevertheless a chronic invalid—he oscillates dally between the surgical dresser's room and a park bench, his family meanwhile suffering the poverty incident to his inefficiency". While improvements in methods of handling acute empyema have decreased the incidence of this condition, it still occurs with sufficient frequency to demand a considerable portion of the chest surgeon's time and consideration.

A patient with chronic empyema has had his disease from six months to twenty-five years, during which period he has usually been subjected to numerous operations. The chronicity of the condition and the difficulty with which chest sinuses and chronic empyema cavities are obliterated have challenged many surgeons, and numerous operations have been devised for their cure. Allen¹ has stated "There has been something of value in most of the methods of treatment advocated. The objectionable feature has been the feeling of some authors that their particular method should be applied to all types of empyema and carried through to a final conclusion". The purpose of this paper is not to present a new operation which is universally applicable, but to outline the important principles in the treatment of chronic empyema and to present a method of attack which has been found valuable in the treatment of this disease.

INCIDENCE AND ETIOLOGY

Management of Acute Empyema.

Graham and Bell⁸ in 1918 and Graham⁹ in 1924, developed and summarized the cardinal principles for successful management of acute empyema. These principles have been reaffirmed by many writers since that time. Briefly these are: (1) Repeated aspiration of the pleural space until the specific gravity of the

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pleural exudate is sufficiently high to signify the formation of pleural adhesions and the partial localization of the empyema cavity, and (2) Institution of adequate drainage and its continuance until the empyema cavity is completely obliterated. While it is acknowledged that closed drainage with suction, with or without tidal irrigation, will satisfy the implications of the term "adequate drainage," nevertheless, in our experience, open drainage of the Connors⁴ type with a large drainage stoma, has been found preferable. Shepard and Claggett¹⁰ analyzed 346 cases of chronic empyema to determine the etiological factors. It is striking to note that inadequate management of acute empyema accounted for 81 per cent of these cases. These investigators determined that 69 per cent of their cases were due to inadequate drainage and 12 per cent were due to delayed drainage. Nowak,¹⁴ in analyzing 500 cases of acute empyema, noted 14 cases of chronic empyema in his series, an incidence of 2.8 per cent. Inadequate drainage was the most important cause of chronicity in these cases. It is therefore important to re-emphasize at this time the fact that adequate drainage instituted at the proper time is the single most important factor in prevention of chronic empyema.

Tuberculosis.

It is difficult to determine the causative rôle of tuberculosis in chronic empyema due to the difference in character of the institutions from which reports are made. In Shepard and Claggett's series, the incidence was reported as 14 per cent. Most writers acknowledge infection with the tubercle bacillus as an important cause of chronicity.

Miscellaneous causes.

Broncho-pleural fistula, bronchiectasis, foreign body, osteomyelitis of the ribs, echinococcus disease, dermoid cyst, and actinomycosis, together, account for less than 10 per cent of the cases.

HISTORY OF OPERATIONS

Measures for re-expansion of lung.

To obliterate the dead space between the retracted lung and the chest wall, Fowler⁶ in 1893, and Delorme in 1894, devised the operation which bears their names. They advocated decortication of the lung by stripping away the firm fibrous envelope from the surface of the retracted lung, allowing the lung to expand. Because of the difficulties of hemorrhage and inability to carry out decortication in some cases, Ransohoff¹⁵ in 1906 made use of discission or the making of criss-cross incisions through the thickened

visceral pleura. Keller practiced chemical decortication, painting the visceral pleura with a saturated solution of gentian violet until it had sloughed sufficiently to allow re-expansion of the lung. Many authors have reported good results with the decortication and discission procedures, but because of the attendant dangers of hemorrhage, fistula formation, and air embolism, these operations are not commonly used at the present time in the treatment of chronic, post pneumonic empyema.

Wilm's Operation.

In 1911 Wilms suggested that short sections be resected from the posterior angles and the costochondral junction of the ribs overlying the empyema cavity. This results in a slumping of the chest wall over the cavity, but does not usually obliterate it, for which reason this operation is seldom employed at the present time.

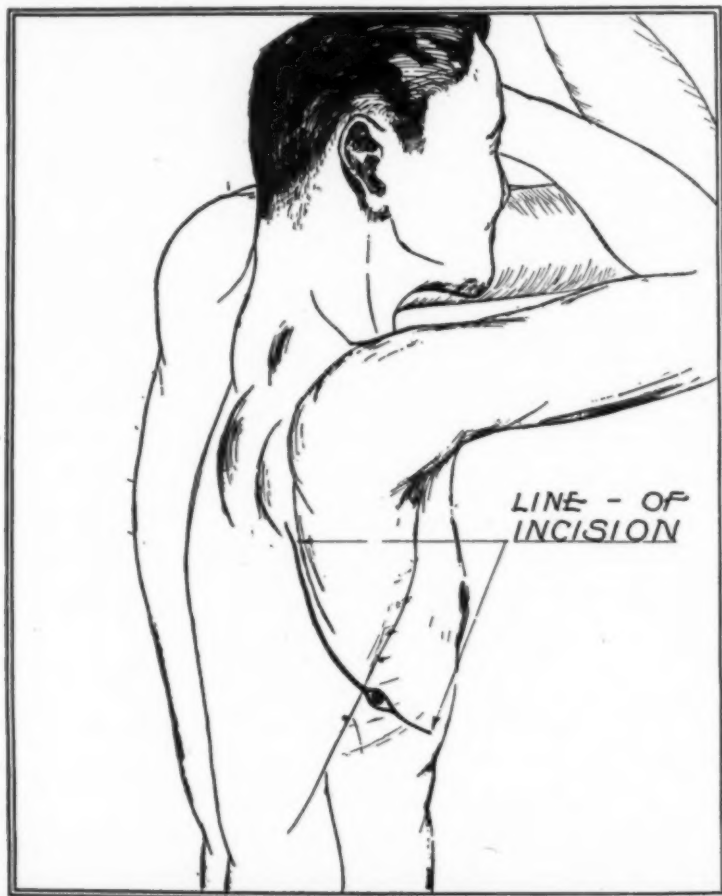


Figure 1: Author's procedure for thoracoplasty in chronic empyema. A curved incision is made over the empyema cavity, excising the cutaneous stoma of the pleurocutaneous fistula. The muscular layers of the chest wall are divided along the line of incision.

Grafts to fill the empyema cavity.

Neuhoff¹³ has successfully closed both empyema and chronic lung abscess cavities with free fat grafts. By rib resection he opens the pleural cavity sufficiently to permit a thorough inspection, and then completely fills the cavity with free fat transplant, taken usually from the gluteal region.

After open drainage for a sufficient period to secure a clean wound and pleura, Carter³ used large pedicle grafts of muscle to fill residual empyema cavities. He employed flaps of the latissimus dorsi and trapezius muscles in the lower portions of the empyema cavities, the sacrospinalis muscles for the apical portions, and the intercostal muscles, as available, to fill the cavity completely. Anteriorly, the pectoral muscles are utilized. As will be shown

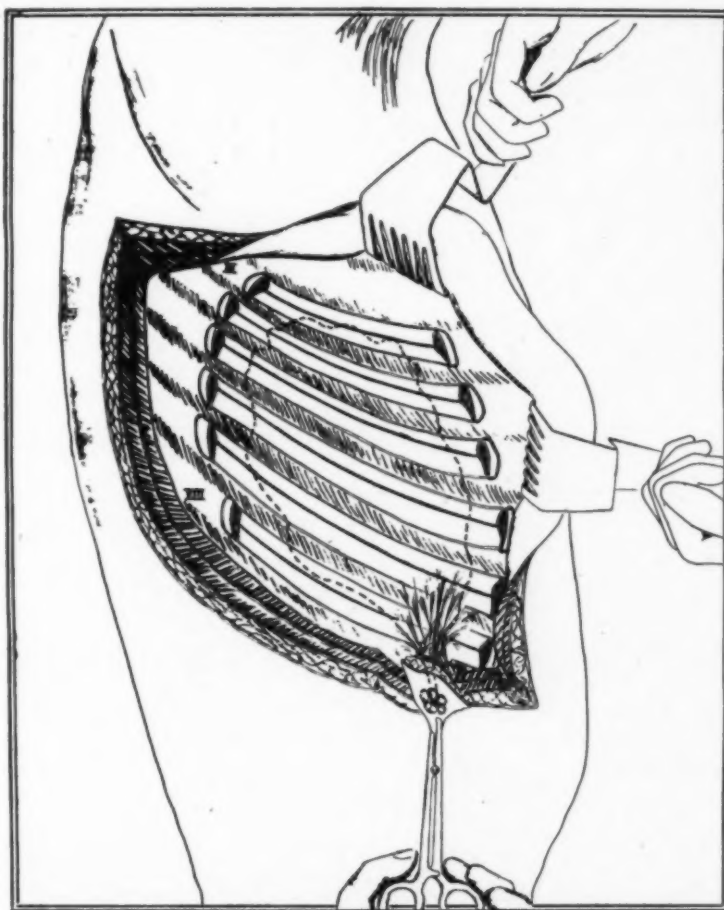


Figure 2: Author's procedure for thoracoplasty in chronic empyema. The dotted line represents the extent of the underlying empyema cavity. The ribs overlying the cavity are resected well beyond its limits. The periosteal beds of the ribs are incised in order that the intercostal bundles may be separated later.

subsequently, muscle flaps used in conjunction with thoracoplasty have been advocated by many authors.

Thoracoplasty.

Estlander early employed thoracoplasty, or the resection of ribs overlying the cavity, to obliterate the dead space in these cases. Because both the visceral and parietal layers of pleura are so avascular, adherence of these two layers and healing is usually considerably delayed, particularly in cases in which there is marked pleural thickening. The principal place of the Estlander procedure today is in the reduction in the size of the cavity and other methods are used to complete the cavity's obliteration.

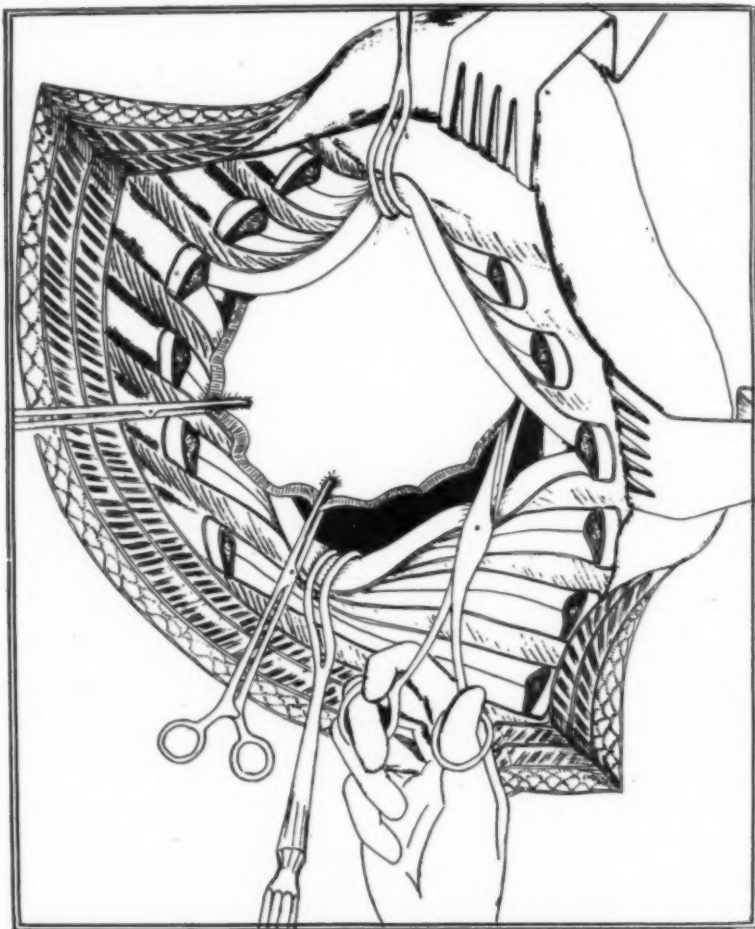


Figure 3: Author's procedure for thoracoplasty in chronic empyema. The intercostal bundles are separated from the underlying parietal pleura by dissection in the endothoracic fascial plane. They may then be retracted at the level where one is working, and the entire parietal pleura forming the roof of the empyema cavity excised. In this drawing the parietal pleura is held by two forceps, and has been divided on all margins except its superior extremity.

Estlander and Schede modified this operation to include under the Schede procedure the unroofing of the empyema cavity by the resection of the ribs, intercostal muscle aponeurosis, parietal pleura, and the scar. In this operation a long parascapular U-shaped incision is made and carried down to the chest wall, lifting a flap of muscle and the scapula. Following the unroofing of the cavity, the visceral pleura is thoroughly curetted, and the musculocutaneous flap is sutured in contact with the visceral pleura. This procedure is accompanied by considerable shock and a high mortality, in some series running as high as 50 per cent. Another serious disadvantage is that the operation results in the partial resection of a number of intercostal nerves with an attendant paralysis of the upper abdominal wall. In most patients this resulting herniation of the abdominal wall and paresthesia of the skin creates a serious disability. Because of the impossibility of regeneration of ribs following the Schede operation, there is paradoxical motion of the chest wall.

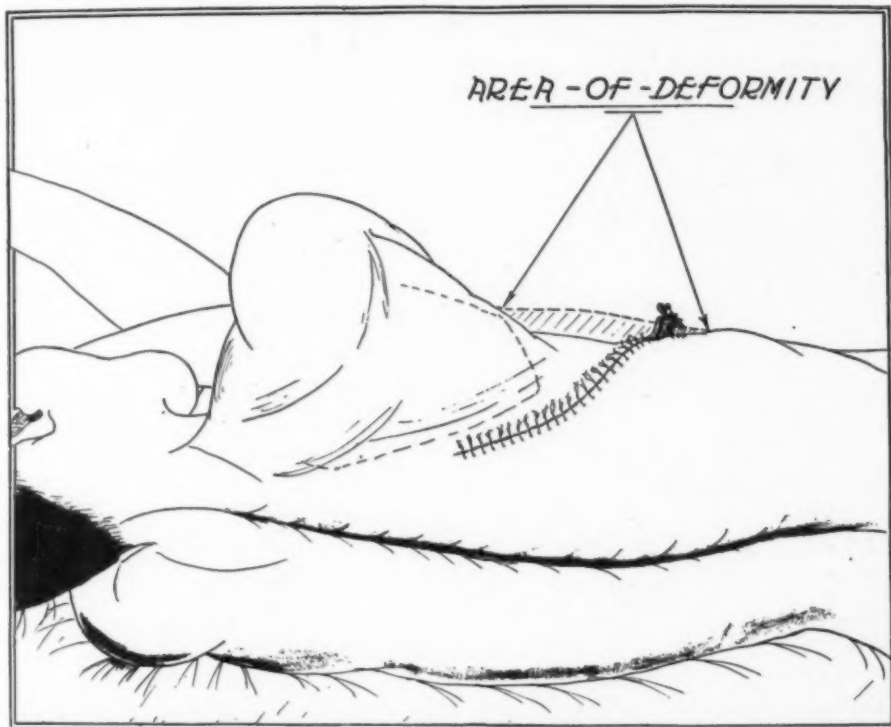


Figure 4: Author's procedure for thoracoplasty in chronic empyema. Closure. Following resection of the parietal pleura, the wound is dusted with sulfanilamide powder and the intercostal bundles allowed to fall into place against the visceral pleura. The muscular layers of the chest wall are sutured over two soft rubber drains which emerge at the lower angle of the wound. The skin is approximated with interrupted sutures. Using mechanic's waste, a compression dressing is applied.

Roberts¹⁶ modified the Schede procedure by employing a hinged flap of parietal pleura and intercostal muscles to help fill in the cavity. After resecting the ribs overlying the cavity, the cavity is laid open along its anterior margin, and the incision is continued around the apex of the cavity in such a way that the thickened parietal pleura, the overlying intercostal muscle bundles, and the periosteum form a pedunculated flap, which is hinged posteriorly, preserving the blood supply. The flap is then held in contact with the visceral pleura with a pack of gauze impregnated with flavin and paraffin. The pack is removed after about one week. Roberts has reported the successful use of this method in 100 cases with one death. This operation, like the Schede procedure, interrupts the intercostal nerves, and is followed by paralysis and paresthesia of the abdominal wall.

Many investigators have demonstrated the efficacy of pedicle muscle flaps in closing bronchopleural fistulae and chronic em-

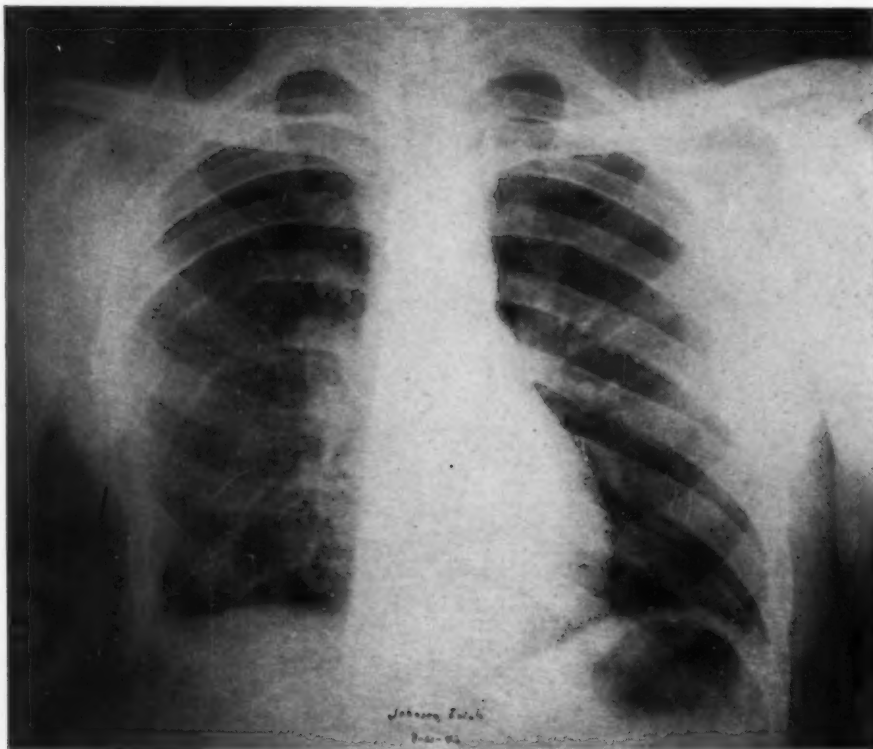


Figure 5: Post-operative x-ray of the chest showing appearance following resection of portions of the 5th to 10th ribs inclusive on the left for chronic empyema with multiple bronchopleural fistulae. In this case, it was not necessary to remove the posterior ends of the ribs. There is a coincident situs inversus in this patient which was apparently not significant.

pyema cavities. Garlock⁷ quotes Abrashanoff as using pedicle muscle flaps to close bronchial fistulae in 1911. Robinson¹⁷ employed pedicle flaps from the latissimus dorsi muscle in conjunction with thoracoplasty to obliterate empyema cavities in 1916. Since that time the use of muscle for this purpose has been firmly established by Pool and Garlock, Keller, Graham, and Eggers. Scrimger successfully used pedicle muscle flaps to fill chronic lung abscess cavities, and as previously noted Carter similarly employed muscle to fill empyema cavities without thoracoplasty.

In 1934, Heller,¹⁰ recognizing the importance of the preservation of the intercostal nerves, advocated the resection of ribs overlying the empyema cavity, followed by the ribboning of the periosteum and the parietal pleura, so that each intercostal bundle was separated from the others and allowed to drop in against the visceral pleura. He thus used the intercostal bundles and the parietal pleura as a filling material. The following year a similar operation was reported by Wangenstein.²² The advantages of this procedure are: The preservation of the intercostal nerves and the subsequent regeneration of ribs, thus eliminating paradoxical motion.

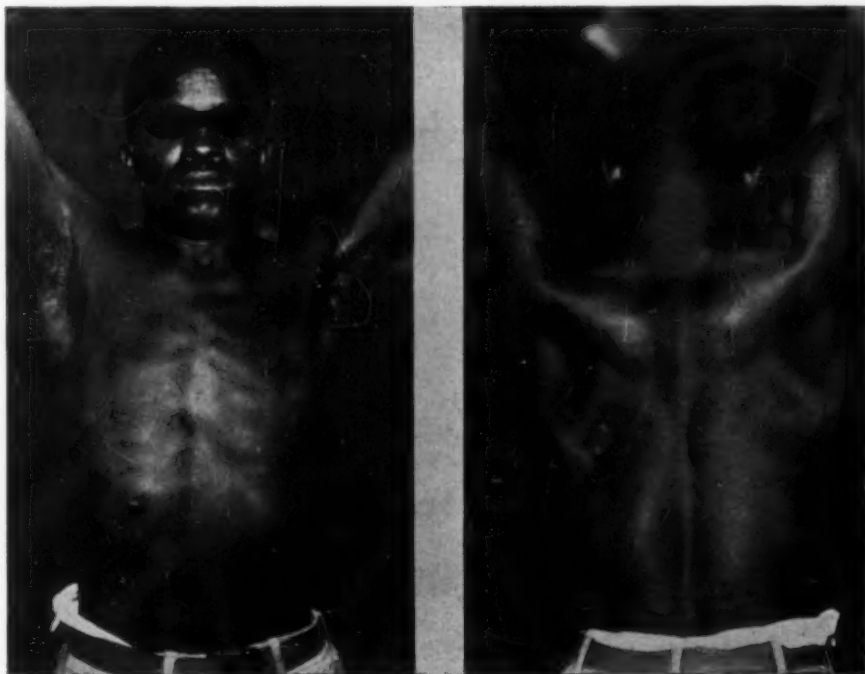


Figure 6: Anterior and posterior views of the patient whose x-ray photograph was shown in Figure 5. Note collapse of chest wall over former site of empyema cavity. There is no apparent loss of function.

AUTHOR'S PROCEDURE

Adequate drainage.

Before resorting to a radical procedure to close a chronic empyema cavity, it is essential that adequate drainage be established and continued for a sufficient period to determine whether or not obliteration of the cavity is occurring. When closed drainage has been employed, open drainage should be resorted to with the resection of two ribs and the intervening intercostal bundle, establishing a large drainage stoma. In cases previously treated by open drainage, revision of the stoma and the creation of a large drainage opening will frequently result in obliteration of the empyema cavity and cure of the disease. This has frequently been seen to occur, although bronchopleural fistulae were present.

Thoracoplasty.

If a period of six weeks elapses after adequate drainage of the empyema without evidence of improvement in the condition, it is our practice to proceed to a thoracoplasty with unroofing of the empyema cavity of a type to be described below. The principles of this operation may be summarized as:

- (1) Rib resection of sufficient length and number of ribs to completely unroof the empyema cavity for a distance of one inch beyond all borders of the cavity. This requires the resection of one rib above and one below the superior and inferior borders of the cavity respectively.

- (2) Separation of the intercostal bundles from the parietal pleura by blunt or sharp dissection in the endothoracic fascial plane. Following the stripping of the intercostal bundles from the underlying parietal pleura, they are ribboned by cutting the periosteum of the beds of the resected ribs. The intercostal bundles may now be retracted upward or downward as necessary for carrying out the following step.

- (3) The intercostal bundles are retracted out of the way as necessary and the entire parietal pleura overlying the empyema cavity is excised. It is essential that no overhanging edges of the parietal pleura be allowed to remain. In patients with unusually thick parietal pleura, it is advisable to bevel the pleura at the margin of the cavity in order to produce a smooth saucer shaped cavity.

- (4) The visceral pleura is then dusted with sulfanilamide powder and the intercostal bundles allowed to fall into apposition with its surface.

- (5) The divided parascapular muscles are sutured with interrupted chromic catgut sutures over a drain which is allowed to

emerge at the lower angle of the wound. It is considered essential to drain these cases in order to allow the escape of serum which would furnish a good culture medium for the bacteria present in the empyema cavity. The skin is closed with interrupted cotton sutures.

(6) A large pressure dressing is applied.

Post operatively, pressure dressings are maintained for five days, at the end of which time the wound is dressed and the drains are shortened. All drains are removed by the seventh postoperative day. Drainage usually continues for some time after removal of the drains, but persisted no longer than 23 days after operation in any of the cases in this series. In all cases sulfadiazine was given in doses of one gram every four hours until the temperature had been normal for three days.

RESULTS

This procedure has been employed in 13 cases of chronic empyema due to pyogenic organisms. In all of these cases healing occurred promptly after the operation, except in one case following pneumonectomy. In this instance a small loculated empyema cavity, separate from the principal cavity, was overlooked at the time of operation. However, his empyema has been reduced to the size of the still unroofed locule, which may require an additional operation. In four of these cases there were bronchopleural fistulae present. In the cases having bronchopleural fistulae, no treatment was given the fistulae, other than allowing the intercostal bundles to fall over their pleural openings. There have been no recurrences.

The method was used in four cases of tuberculous empyema, all of which healed promptly, and have remained healed to the present time.

There was no mortality in this series.

SUMMARY AND CONCLUSIONS

A study of the reported cases of chronic post pneumonic empyema reveals that the single most important cause of this condition is error in the management of acute empyema. Inadequate drainage is the single most important factor in the causation of chronicity of this lesion. Tuberculosis and a variety of miscellaneous causes account for the remaining cases.

A method of surgical obliteration of chronic empyema cavities has been presented. The advantages of this method are: (1) The preservation of the intercostal nerves and vessels, with the absence of paresthesia and herniation of the abdominal wall. (2) The preservation of the periosteum of the resected ribs, resulting in

regeneration of bone and stabilization of the chest wall. (3) The intercostal bundles, when stripped of the underlying thickened parietal pleura, have an abundant blood supply and adhere very quickly to the visceral pleura, thus producing rapid obliteration of the chronic empyema cavity. The rapid healing of the wound following this procedure is a decided advantage.

The procedure has been used in 13 chronic empyemas due to pyogenic organisms and 4 chronic tuberculous empyemas with encouraging results.

RESUMEN Y CONCLUSIONES

El estudio de los casos de empiema postneumónico crónico acerca de los cuales se han presentado informes revela que la causa más importante de este estado es el tratamiento errado del empiema agudo. El drenaje inadecuado es el factor más importante para causar cronicidad en esta lesión. La tuberculosis y una variedad de causas diversas son responsables por los casos restantes.

Se ha presentado un método para la obliteración quirúrgica de cavidades de empiemas crónicos. Las ventajas de este método son: (1) La preservación de los nervios y vasos intercostales, con la ausencia de parestesia y hernia de la pared abdominal. (2) La preservación del periostio de las costillas resecaadas, a fin de producir la regeneración ósea y la estabilización de la pared torácica. (3) Los manojos intercostales, despojados de la engrosada pleura parietal subyacente, tienen una circulación abundante y se adhieren muy rápidamente a la pleura visceral, produciendo así la rápida obliteración de la cavidad del empiema crónico. La cicatrización rápida de la herida, que sigue a este procedimiento, es una ventaja definitiva.

Se ha empleado este procedimiento en 13 empiemas crónicos causados por gérmenes piógenos y en 4 empiemas tuberculosos crónicos, con resultados halagüefos.

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Discussion

MINAS JOANNIDES, M.D., F.C.C.P.
Chicago, Illinois

Colonel Grow is to be congratulated for his ingenious way of tackling the therapy of chronic empyema of the chest. His operation is quite an improvement over the Estlander and Schede technics.

But we should not have chronic empyema. It is unfortunate that the average patient with pleural effusion is not recognized early enough or treated properly during the early stages so that the process goes merrily on to the stage of chronicity with pleural thickening which eventually necessitates some sort of body-deforming operation before it is cleared up.

The basic problems in pleural effusions are: 1) prevention, 2) early recognition, and 3) early proper care. We must realize that every patient with a congestive lesion in the lung is a candidate for pleural effusion. If the congestive changes in the lung are of bacterial origin, the effusions are generally infected and when they remain untreated the process of suppuration goes on through its biologic stages, with the ultimate development of thick walled empyema.

A few words on the mechanism of the production of effusions may be of value in the prevention of empyema.

The visceral pleura should be regarded as a thin, fairly loose covering of the lung, and it has a certain degree of air tightness and water tightness. Functionally it has the same qualities as the peritoneum. Under normal conditions we see that there is a certain degree of seepage of fluid from the lung proper on the visceral pleura. The secretion of this serum is instrumental in preventing friction between the lung and the chest wall during the process of pulmonary expansion and contraction.

We have found experimentally that the rate of seepage of fluid from the lung is in a direct ratio to the degree of fluid accumulation in the alveoli and also in an indirect ratio to the capacity of the heart to pump these exudates from the lung into the general circulation.

It is obvious, therefore, that in order to prevent the development of effusions during congestive disease of the lung, we must always support the tonus of the heart muscle and avoid heart strain especially in patients with a tendency to a low blood pressure.

When the effusion becomes unavoidable it becomes necessary to remove the fluid in order to prevent further compression and atelectasis in the lung with a higher rate of seepage. One exception to this rule is in the case of tuberculous effusions where we generally maintain a pulmonary collapse although we remove the effusion by repeated aspirations, and when pyogenic infection is also present we do an oleothorax using olive oil with 1-20.000 concentration of metaphen in oil.

In pyogenic effusions it is necessary not only to remove the fluid from the pleural cavity but also to attack the invading organism systemically and locally.

It is our practice that as soon as we determine the type of bacterial etiology after one or two aspirations for diagnostic purposes, to institute a closed drainage of the pleural cavity and attach a mushroom drainage catheter to a closed negative pressure system for constant drainage and maintenance of negative pressure in the pleural cavity.

We insist on the use of a Pezar urethral catheter because with its use we avoid the complications that may arise from the use of an ordinary catheter whose pleural tip may dangle anywhere in the chest and not allow proper drainage.

We irrigate the pleural cavity through the catheter with 1-3000 solution of azochloramid once a day. Since penicillin became available for general use we have used it locally with good results in pyogenic effusions. We have used 2000 to 4000 units intrapleurally once a day and take bacterial counts of the effusion to check its effect.

This routine has given us three important results which prevent

chronicity. First, we mechanically remove the exudate or transudate. Second, we avoid compression of the lung and reduce the tendency to further exudation of fluid. Finally, we limit the growth of pathogenic organisms to an absolute minimum and thus avoid the development of suppuration.

About 90 per cent of our cases have gotten well with this routine and open drainage of the pleural cavity became unnecessary. In the remaining 10 per cent that do not respond, we institute open drainage with irrigation of the cavity two or three times daily with azochloramid. When a bronchial fistula is present we do a thoracoplasty just as soon as the patient can stand the shock of the operation.

In chronic empyema with thickened visceral and parietal pleura and a fixed mediastinum the sooner we reduce the dead space in the pleura, the quicker the patient will get well. A thoracoplasty with added outside compression of the chest wall until the resected ribs regenerate has been our method of choice.

The operation described by Doctor Grow has the important advantage of causing less deformity in the chest wall than an orthodox thoracoplasty.

Again I want to congratulate Colonel Grow on his operation and I assure him that I will try it on my next case of chronic pleural empyema.

of Evaluation of Various Surgical Procedures in the Treatment of Pulmonary Tuberculosis*

RALPH C. MATSON, M.D., F.C.C.P.; WILLIAM S. CONKLIN, M.D., F.C.C.P.
and SHELDON DOMM, M.D.**

Portland, Oregon

This presentation is based on an extensive experience in surgical collapse therapy in the treatment of pulmonary tuberculosis beginning with an experience first with artificial pneumothorax in 1910, which while operative is not surgical and will not be discussed, and with comprehensive utilization of recognized surgical procedures since 1925, involving approximately 4,000 cases.

It is admittedly true that a clinician's impressions frequently may be at variance with an accurate statistical analysis of his material. It is likewise true that statistics may lose some of their accuracy in that they do not take into account errors in judgment or technique. In general one's results tend to improve with experience, and a statistical survey of a large volume of material may fail completely to reflect the evolution that has occurred. Indeed it can be stated with equanimity that, because of its extraordinary complexity, tuberculosis is a disease the treatment of which does not admit to accurate statistical review, and in the end we are duty bound to rely largely on the clinical impressions of others and ourselves.

Therefore, in this discussion, the various surgical procedures utilized in the treatment of pulmonary tuberculosis, including pneumonectomy and lobectomy will be evaluated briefly in the light of our personal experience.

Bronchoscopy is routine in all our cases, with certain exceptions, eg. early minimal cases with negative sputum, in order to determine the presence of tuberculous bronchitis with or without stenosis. Artificial pneumothorax is contraindicated in the presence of ulcero-granular or stenotic bronchitis, and it is our impression that lobectomy or pneumonectomy will prove to be the procedure of choice in such cases. Bronchoscopy also is utilized in order to evaluate the progress of a bronchial lesion developing in cases of pulmonary tuberculosis undergoing collapse therapy, or in which a non-expanding lung has resulted from improper

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**From the Department of Surgery, University of Oregon Medical School, the Thoracic Surgery Service of the University State Tuberculosis Hospital, and the Portland Open Air Sanatorium.

pneumothorax management. Likewise bronchoscopy is indicated prior to lobectomy in order to study the anatomy of the primary bronchi, and also in order to provide improved drainage in cases with stenosis.

Closed Intrapleural Pneumonolysis with the use of the high frequency current is standard for the severance of pleural adhesions interfering with a satisfactory pneumothorax. Operation is indicated as soon as there is evidence that adhesions are responsible for the failure of artificial pneumothorax to close cavities or provide adequate lung rest after a reasonable trial, ie. three months. Pneumonolysis also is indicated when the pressure required to obtain a satisfactory pneumothorax causes uncomfortable mediastinal displacement and downward pressure upon the hemidiaphragm producing anorexia, nausea, vomiting and loss of weight. The operation also is indicated in cases in which traction of adhesions causes chest pain and when in spite of a negative sputum, adhesions are contracting, causing premature expansion of the lung. An attempt is made to sever all adhesions of clinical importance, and if this cannot be accomplished no adhesions are cut, the pneumothorax is abandoned, and the lung is permitted to reexpand. This attitude is taken because of our desire to avoid the complications unjustifiably attributed to the operation.

Extrapleural stripping after intrathoracic infiltration of the endothoracic fascia with procaine, is entirely feasible in the closed technique, even in the region of the subclavian bed. Open pneumonolysis, a major procedure still used by those who are unfamiliar with the technique of the closed method, does not permit the scrupulous observation and safe severance of adhesions which thoracoscopic technique permits, and therefore is obsolete.

Intrapleural Oleothorax with the use of 1 per cent Gomenol, properly aged in mineral oil, is a valuable procedure in our hands for the control of tuberculous empyema, oftentimes rendering thoracoplasty unnecessary. It is also utilized to prevent loss of a pneumothorax space by obliterative pleuritis, and to provide counter-pressure in certain cases of bilateral pneumothorax. The use of oleothorax requires more experience than does the use of pneumothorax, and although it may appear to diminish the number of treatments necessary, oleothorax requires infinitely more attention. Many failures may be attributed to lack of knowledge with regard to indications and proper technique.

Monaldi Transthoracic Cavity Suction Drainage is employed with satisfaction in a strictly limited group of cases. The chief criterion for use of this procedure is intracavity pressures, as determined by manometric studies after proof of pleural symphysis. Monaldi suction is of therapeutic value only in cases of

tension cavity with stenotic valve-type draining bronchus. In a few such cases the Monaldi procedure apparently has entirely closed the cavity, but in the vast majority of cases a small residual cavity remains, and must be collapsed by thoracoplasty. However we occasionally employ the Monaldi drainage purely as a palliative procedure in hopeless cases with severe cough and massive sputum volume. In general it can be said that the enthusiasm with which the Monaldi procedure was introduced into this country has proved unjustifiable in our opinion.

Interruption of the Phrenic Nerve is utilized much less frequently as time goes by. It is considered only for lower lobe cases in which pneumothorax is impossible and lobectomy is not practical, and in all cases of chronic empyema in order to reduce the surface area of infected pleura. We always perform a temporary interruption, and subsequently make the interruption permanent only in selected right-sided cases. Radical phrenic neurectomy is not done on the left side because of the possibility of gastric dilatation.

Pneumoperitoneum is induced frequently following phrenic interruption in order to provide additional collapse of the lung by increasing the elevation of the paralyzed hemidiaphragm. The value of this procedure has been over-estimated and it is being used with decreasing frequency.

The Extrapleural Pack of Flexi-Tissue filled with Vioform Gauze is used with good results in a rather limited group of cases. Its chief indications include closure of residual cavities remaining after unsuccessful thoracoplasty, and in preference to a limited upper phase thoracoplasty. The avoidance of the tedious technique of a revision thoracoplasty, and compression accurately applied over the unclosed or residual cavity are attractive features of this operation. Less valid indications include those cases in which a poor general condition contraindicates a more shocking and irreversible operation such as apicolysis or thoracoplasty. We have arrested certain cases of tuberculous bronchiectasis of the upper lobe by means of the pack operation.

Exudate will occur in the extrapleural pack space in a good proportion of cases in time, but the mere presence of exudate does not justify the removal of the pack, for the exudate frequently absorbs. In case the patient develops a febrile course with evidence of possible spontaneous rupture through the incision, or of increasing pressure on the lung, the pack is removed, and the space either is converted into an extrapleural oleothorax, is permitted to obliterate, or the extrapleural fluid is allowed to accumulate and organize. We do not use plumbage, fat, muscle, air, agar, or rubber in our extrapleural procedures. During the war it

became impossible to replenish our supply of Flexi-Tissue. After considering numerous substitutes I finally decided to try Fiberglass tape. My experiences to date suggest that this may prove to be the most satisfactory material for extrapleural packs in the occasional case wherein such packs seem to offer the optimum chance of cure.

The Extrafascial Apicolysis of Semb, modified by Gale, as employed on our service consists of removal of the upper three ribs in toto with a part of the fourth rib, including portions of the corresponding transverse processes, and extrapleural pneumonolysis as far inferiorly as indicated, with section of the connective tissue bundles overlying the apex of the lung. The wound is drained for 48 hours but subsequent accumulation of fluid is permitted in order to aid collapse. Cases considered suitable for apicolysis include those with cavities located above the fourth rib posterior, and certain cases of tuberculous bronchiectasis of the apex. Apicolysis is not employed routinely in our thoracoplasties.

Extrapleural Thoracoplasty remains the standard operation for collapse of pulmonary cavities unclosed by pneumothorax or other less radical procedures, especially in the case of upper lobe lesions, and for cases of extensive lesions without cavity. We feel however that the results of thoracoplasty in cases of lower lobe lesions, tension cavities, and so-called "hilar" cavities are not always satisfactory, hence we now consider certain of such cases for lobectomy rather than thoracoplasty. Thoracoplasty is also used routinely in order to collapse the hemithorax in cases of chronic tuberculous or mixed infection empyema when oleothorax is not successful or contraindicated, as in the presence of bronchopleural fistula. Likewise a thoracoplasty is done prior to a major thoracotomy for all empyema spaces containing over 500 cc.

We use standard technique with special emphasis upon short rib stumps with resection of the transverse processes and exarticulation of the ribs as indicated, and minimal intervals between stages.

Major Thoracotomy or Undecking is utilized in empyemas of less than 500 cc. volume, which have not diminished in size for a month or so under aspiration or tube drainage and irrigation, and in which efforts to expand the lung are ineffectual. Ordinarily the wound is sutured open, and at a later date pinch grafting or muscle fill are resorted to in cases in which the filling by granulation progresses too slowly. Muscle fill likewise is the procedure of choice in cases of broncho-pleural fistula.

Lobectomy and Pneumonectomy are being carried out with increasing frequency and satisfaction. Indications at present include tuberculous bronchiectasis, tuberculous bronchitis with stenosis,

lower lobe and so-called "hilar" cavities, "non-collapsible" cavities, tuberculomas and unilateral disease which has not responded to collapse therapy, especially thoracoplasty, or in which multiple cavities and extensive destruction of lung tissue have developed. During the past year, we have done pneumonectomies for tuberculosis in five cases. Two of these are clinically cured, a third has negative sputum for the first time in five years, but is still hospitalized on account of roentgenological evidence of an active lesion in her remaining lung. There were two deaths, one occurring during closure of the chest wall from sudden rupture of the pulmonary artery, the other from a tuberculous pneumonia developing postoperatively in the remaining lung. In the six lobectomies which we have done for tuberculosis during the past year, there has been sputum conversion in all cases with no mortality nor serious complications.

The hilar structures are individually ligated in both pneumonectomy and lobectomy, and the bronchial stumps are closed by means of simple interrupted stainless steel wire sutures. Lobectomies are drained for varying periods of time with the aid of Wangenstein suction in order to promote obliteration of the pleural space by expansion of the remaining lobe or lobes, elevation of the hemidiaphragm, and retraction of mediastinal and thoracic wall structures. In our cases we have seen no reason to drain the pneumonectomies, but rather permit the sterile pleural fluid to accumulate. Should empyema, with or without bronchial fistula, develop postoperatively, its treatment would follow the accepted lines. In the presence of a fistula, drainage must be instituted immediately and a complete thoracoplasty will probably be necessary in most of these cases.

Oral sulfonamide therapy is employed pre- and postoperatively, and sulfathiazole is insufflated into the pleural space before the wound is closed. An attempt is made to induce pneumothorax prior to pulmonary resection in order to obtain physiological adjustment to the use of only one lung, and to make the operation technically easier for the surgeon and less shocking to the patient. Thoracoplasty is not performed as a preliminary procedure.

Since this paper was presented there has been some modification in my technique for resections. I now use tantalum (0.007 inch) in place of stainless steel for closure of the bronchial stump. I rarely find it necessary to drain lobectomy cases except by thoracenteses, rarely do we induce a pre-operative pneumothorax and penicillin is used in place of, or in addition to, the sulfonamides.

Other Procedures: Multiple intercostal neurectomy is utilized occasionally purely for relief of intractable intercostal pain. Sca-

leniotomy, undecking of pulmonary cavities, and subcostal supra-periosteal muscle fill have been entirely abandoned.

CONCLUSION

Our experience belies the statement that the prognosis of the patient with pulmonary tuberculosis is no better now than it was before the use of surgical procedures. However, it may well be that the point of diminishing returns has been reached with regard to collapse therapy, and that lobectomy and pneumonectomy will be the means whereby additional cases can be helped until some specific therapeutic agent is discovered.

RESUME

This presentation is an evaluation of various surgical procedures utilized in the treatment of pulmonary tuberculosis (except artificial pneumothorax) based on an extensive personal experience.

Routine Bronchoscopy is utilized in selection of cases for surgery. Pneumothorax is contraindicated in cases of active tuberculous bronchitis or residual stenosis. Study of endobronchial anatomy is important prior to lobectomy or pneumonectomy.

Early Closed Intrapleural Pneumonolysis with high frequency current is standard for severance of pleural adhesions interfering with a satisfactory pneumothorax.

Intrapleural Oleothorax is a valuable procedure for the control of tuberculous empyema and obliterative pleuritis.

Monaldi Transthoracic Cavity Suction Drainage is of therapeutic value only for tension cavities not suitable for extirpation by lobectomy.

Interruption of the Phrenic Nerve and Pneumoperitoneum are procedures of limited value in lower lobe cases, and are decreasing in popularity. Phrenic interruption is routine in cases of chronic empyema.

The Extrapleural Pack of Flexi-tissue filled with Vioform gauze is of value as a means of closing residual cavities remaining after thoracoplasty, and in preference to upper phase thoracoplasty in poor risk cases.

Extrascapular Apicolysis is used with good results to collapse apical cavities.

Extrapleural Thoracoplasty is the standard operation for collapse of pulmonary cavities not closed by less radical procedures, for extensive lesions without cavity, and in chronic empyema uncontrolled by oleothorax. In recent years there has been a trend towards limitation of indications with exclusion of certain types of cases now considered more suitable for lobectomy.

Major Thoracotomy is successful in selected cases of chronic stationary empyema of less than 500 cc. capacity. Muscle Fill often hastens closure and is the procedure of choice in cases of broncho-pleural fistula.

Lobectomy and Pneumonectomy offer hope for cure in cases previously resistant to treatment, eg. bronchial stenosis, "uncollapsible cavities," and tuberculous bronchiectasis. Individual ligation of hilar structures and use of sulfonamides are factors in our negligible complication rate.

CONCLUSION

Nuestra experiencia desmiente la declaración de que el pronóstico del tuberculoso pulmonar no es mejor ahora de lo que era antes del empleo de procedimientos quirúrgicos. Sin embargo, puede ser que ya se haya alcanzado la utilidad máxima obtenible con la colapsoterapia, y que la lobectomía y la neumonectomía serán los medios de ayudar a casos adicionales hasta cuando se descubra algún agente terapéutico específico.

RESUMEN

Esta presentación es un avalúo de los varios procedimientos quirúrgicos utilizados en el tratamiento de la tuberculosis pulmonar (excepto el neumotórax artificial) basado en una experiencia personal extensa.

Se emplea la Broncoscopia sistemática en la selección de casos para la intervención quirúrgica. El neumotórax está contraindicado en los casos de bronquitis tuberculosa aguda o de estenosis residual. Es importante el estudio de la anatomía endobronquial previa a la lobectomía o a la neumonectomía.

Se emplea tempranamente la Neumonolisis Intrapleural Cerrada con la corriente de alta frecuencia para seccionar adherencias pleurales que impiden el neumotórax satisfactorio.

El Oleotórax Intrapleural es un procedimiento valioso para el control del empiema tuberculoso y la pleuresía obliterante.

El Drenaje Cavitario Transtorácico con Succión de Monaldi tiene valor terapéutico solamente en las cavernas de tensión no apropiadas para la extirpación mediante la lobectomía.

La Intervención en el Frénico y el Neumoperitoneo son procedimientos de valor limitado en lesiones de los lóbulos inferiores, y su popularidad va en vías de disminución. Se practica sistemáticamente la frenicectomía en casos de empiema crónico.

El Tapón Extrapleural con *Flexi-tissue* relleno con gasa de *Vioform* es un método valioso para el cierre de cavernas residuales que persisten después de la toracoplastia, y es preferible a una toracoplastia limitada en malos riesgos quirúrgicos.

Se emplea con buenos resultados la Apicolisis Extrafascial para el colapso de cavernas apicales.

La Toracoplastia Extrapleural es la operación de elección para el colapso de cavernas pulmonares no cerradas por procedimientos menos radicales, para lesiones extensas sin caverna y en el empiema crónico no cohibido por el oleotórax. En los últimos años ha existido una tendencia hacia la limitación de las indicaciones con la exclusión de ciertas clases de casos que ahora se consideran más apropiados para la lobectomía.

La Toracotomía Mayor obtiene buen éxito en casos seleccionados de empiema crónico estacionario de menos de 500 cc. de capacidad. El Colgajo Muscular frecuentemente acelera el cierre y es el procedimiento de elección en casos de fistula broncopleurale.

La Lobectomía y la Neumonectomía ofrecen la esperanza de curación a casos previamente resistentes al tratamiento, tales como estenosis bronquial, "cavernas irreductibles" y bronquiectasia tuberculosa. La ligadura individual de los tejidos hiliares y el uso de los sulfonamidos son factores en la proporción insignificante de nuestros casos complicados.

Discussion

W. W. BUCKINGHAM, M.D., F.C.C.P.
Kansas City, Missouri

Dr. Randolph and Members of The American College of Chest Physicians:

I have enjoyed Dr. Matsons' paper very much and wish to compliment him on the clear and concise manner in which he has evaluated the different surgical procedures which have run their cycle of popularity in the last few years.

As we look back through the last decade, we have been heartily enthusiastic with each new surgical therapeutic procedure that has been presented. The great majority of us have followed along like sheep until we found its limitations. The pendulum has then swung back until either the procedure has been discarded or the indications have become narrowed down to such a point that the procedure is rarely used except in particularly specialized cases.

Bronchoscopy should be used routinely in all pre-operative pulmonary cases, but in certain clinics, working under certain difficulties, this goal is almost impossible to attain. If one will take a careful history as to periods of wheezing or asthma, and will make a careful physical examination, one can usually find

the cases in which bronchoscopy is very definitely indicated and bronchoscopy certainly should be used in these cases. Using bronchoscopy as a routine procedure, the percentage of finds is so small that in some instances it is not economically feasible.

Dr. Matson is, of course, a pioneer in developing the operation of closed intrapleural pneumolysis and we all know there are dangers and complications following this procedure. I am wondering exactly what Dr. Matson means by adhesions of clinical importance. In some sections of the country, any adhesion, regardless of its size or position, is an indication for operation. In other sections the operation is rarely used. There must be a happy medium obtained. We all see satisfactory pneumothorax with adhesions, with closure of cavities and negative sputum. I would like to ask Dr. Matson if, in this type of case, the danger of future activation of the disease upon re-expansion of the lung in 2 or 3 years is not less than the immediate dangers of the complications following severance of adhesions in early cases. I only bring out this point to try to emphasize the fact that in the sanatorium the younger men all wish to operate upon these cases without giving the pneumothorax an adequate chance to bring about an arrest of the disease.

In the Northwest oleothorax has been used in a large number of cases and with very satisfactory and gratifying results. When the procedure was first discussed it was thought by some that it would be an entire replacement for pneumothorax and would completely obviate refills. This of course, could not be true and the indications for its use have now levelled off more or less as a complementary procedure for our pneumothorax failures, namely, tuberculous empyema, obliterating pneumothorax, etc.

The Monaldi procedure, in my own mind, was never a safe or sane surgical procedure and for this reason I have used it only in a small number of cases; yet I believe it has not stood the test of time and it is my opinion that it should only be used, more or less, as a salvage measure and for the relief of subjective symptoms.

Operations upon the phrenic nerve are still justified and should be used more frequently. In my hands, I have had better results in apical tuberculosis than in basal involvement. If we are very careful to evaluate what is expected from the operation, if we do not expect too much from it, we will be more than gratified with its use. For example, if due to excessive pleural scarring, pain is one of the symptoms due to traction of the entire hemothorax, paralysis of the diaphragm may cause enough relaxation to diminish this pull while not affecting, in any way, the tuberculosis. If the indication was merely the relief of pain, the operation has been successful. If one is careful about the indications and the

expectations of the operation, it will give gratifying results, particularly in early cases of infiltration or even cavitation.

In our own hands, I doubt if we have seen a satisfactory end result with pneumoperitoneum alone and it is used only as an adjunct in the preparation of a patient for further surgical procedure.

It was only a few years ago that extrapleural paravertebral thoracoplasty could not be done unless a modified Semb's apicolysis was done in conjunction. I believe that this procedure has now been more or less discarded for the old stand-by, straight extrapleural thoracoplasty, due of course, to the fact that too many reexpansions of the apex with opening of the cavity occurred.

A selective thoracoplasty can be obtained allowing utilization of the lower lung-field if we can limit our thoracoplasty to six ribs, removing the transverse processes and taking large lengths of the first, second, third and fourth ribs almost to the cartilages with resection of a small tip of the angle of the scapula. In this way we avoid overriding of the seventh rib, the scapula remains as an extrapleural pack, particularly if the patient rides his pillow. The objection of a seventh and eighth rib thoracoplasty in interfering with respiratory mechanism is overcome. I have been using this more or less as a standard type and have had excellent results.

In the last two or three years everyone seems to want to get on the bandwagon with the operations of lobectomy and pneumonectomy for pulmonary tuberculosis. At the present time, I think the pendulum is swinging far toward the radical side and, as has been the case in the procedure previously described, the pendulum will swing back.

I believe we will have to differentiate between parenchymal tuberculosis and bronchial tuberculosis. It is my prediction that ultimate indications for lobectomy and pneumonectomy will be more or less confined to bronchial tuberculosis. It makes little difference whether we are dealing with tuberculous ulcerations, stenosis or bronchiectasis. They are all the same disease in the same organ and merely a matter of extensive involvement. For the pure parenchymal disease with a pure parenchymal type of pulmonary tuberculosis, I have not seen any cases in which a thoracoplasty would have not accomplished the same results with a higher percentage of cure and a lower mortality rate. It is my opinion that lobectomy and pneumonectomy will be confined to bronchial involvement.

We have all had patients, who upon first being informed that they had pulmonary tuberculosis, ask the reason for not just cutting-out the disease, throwing it in the waste-paper basket and

letting them go on their way, much as one would a diseased gall-bladder. We must remember that tuberculosis is a systemic disease with local manifestations regardless of what organ it settles in and we must insist upon adequate post-operative and generalized rest even though we have taken a short-cut with surgical means. This holds true whether we are dealing with pneumothorax, thoracoplasty or lobectomy.

I wish to thank Dr. Matson for the courtesy of being allowed to discuss his very excellent paper. Thank you.

The Treatment of Tuberculous Empyema*

KARL P. KLASSEN, M.D., MYRON D. MILLER, M.D., F.C.C.P., and
GEORGE M. CURTIS, M.D., F.C.C.P.**

Columbus, Ohio

The complexity of the problem of tuberculous empyema as it occurs in patients undergoing collapse treatment for pulmonary tuberculosis makes an evaluation of past experience and results obtained by clinicians of various tuberculosis hospitals most desirable. There have appeared excellent reports on this subject from the various large centers, such as the Sea View Hospital,¹ Saranac Lake,² Ann Arbor³ and the Hamilton County Tuberculosis Hospital.⁴ The published results of these investigations have helped greatly to clarify the once extremely confused subject of tuberculous empyema. However, additional reports from other tuberculosis hospitals should be made available to aid in establishing a uniform plan of attack on this problem.

The present report is based on the experience of the authors in dealing with tuberculous empyema in a typical county tuberculosis hospital. At the Franklin County Tuberculosis Hospital, with a total capacity of 309 beds, and a yearly admission of approximately 235 patients, there has been a gradual decrease in the incidence of tuberculous empyema. This is apparently due to a more selective application of the various types of collapse procedures. Every patient with pulmonary tuberculosis admitted to the hospital is considered individually and during conferences of the medical and surgical staffs, therapeutic procedures are outlined and discussed which promise to bring about the most satisfactory results in each given case. Pneumothorax is still considered the most satisfactory collapse procedure in our hand at the present time; however, it is not universally applicable and is not used in every patient with pulmonary tuberculosis. In patients with unilateral caseation and excavation, except in cases of acute caseous pneumonia, pneumothorax is attempted before any other procedures are used. These cases promise the best results in that an adequate collapse can be established in a high percentage of cases. An unsatisfactory collapse can often be made adequate by the use of closed pneumonolysis and phrenic nerve paralysis.

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**From the Department of Research Surgery, the Ohio State University and the Franklin County Tuberculosis Hospital, Columbus, Ohio.

These operative procedures are applied early since an inadequate collapse carries with it a high rate of tuberculous empyema formation. When a pneumothorax remains inadequate, after pneumonolysis and phrenic nerve surgery have been tried or obviously could not be applied, the pneumothorax is discontinued at once and after complete re-expansion of the lung, extrapleural thoracoplasty in multiple stages is used.

In certain patients with bilateral caseation and even excavation, bilateral pneumothorax, when adequate, brings about satisfactory results. Pneumothorax and contralateral thoracoplasty have now been used in a considerable number of patients with excellent end results. The maintenance of inadequate pneumothorax in patients with bilateral disease as a rule carries with it a high incidence of tuberculous empyema and spontaneous pneumothorax. Such complications place the burden of respiratory function on the contralateral involved lung with rapid fatal termination of the disease.

The present report deals with cases of tuberculous empyema which developed in patients admitted to our hospital from January 1, 1937 to January 1, 1942. All patients have been observed over a period of from two and a half to seven and a half years. Patients with tuberculous effusion, clear fluid containing acid fast bacilli, were not included in this report. Such fluid may eventually become turbid and thick and the effusion may lead to a tuberculous empyema. We speak of a tuberculous empyema only when the aspirated fluid is thick or turbid and contains acid fast bacilli, demonstrated by direct smear, culture or guinea pig inoculation. Patients who developed empyema prior to January 1, 1937 were not included in our study, since our records were then incomplete and the diagnosis was frequently based on clinical impression rather than on actual laboratory proofs.

In the 5 years under consideration there were admitted to the Franklin County Tuberculosis Hospital a total of 1266 patients (Table I). As in other county tuberculosis hospitals, approximately two-thirds of these patients had far advanced disease. Pneumo-

TABLE I

The Incidence of Tuberculous Empyema in Patients with Pulmonary Tuberculosis of the Franklin County Tuberculosis Hospital admitted from Jan. 1, 1937 to Jan. 1, 1942.

| | |
|--|------|
| Number of Patients Admitted | 1266 |
| Number of Patients with Pneumothorax | 804 |
| Number of Patients with Tuberculous Empyema | 61 |
| Incidence of Tuberculous Empyema in Pneumothorax | 7.6% |

thorax was attempted in 804 cases, of which a number were not successful and were discontinued after a relatively short time. Sixty-one patients developed tuberculous empyema, which is an incidence of 7.6 per cent. Only one patient with effusion and without demonstrable parenchymal disease had a negative sputum. All other patients had a positive sputum prior to or after admission to the hospital. The diagnosis of tuberculous empyema was based on finding the tubercle bacilli in the aspirated fluid.

Hedblom's⁵ classification of tuberculous empyema is an excellent working basis in helping to determine the proper type of treatment. He and also John Alexander divide tuberculous empyema into two main groups. First there are the pure tuberculous empyemas, the pus being sterile on the usual smear and culture, but containing acid fast bacilli. The second group is composed of empyemas due to a mixed infection, that is the usual pyogens, streptococci and staphylococci with a large number and variety of aerobes and anarobes and the tubercle bacilli. The treatment of these two groups is quite different. In tuberculous empyemas open drainage is decidedly contraindicated, while in the mixed infections, adequate and immediate drainage may be life saving. Recent experience with penicillin indicates that a high percentage of these mixed empyemas may be converted into the more favorable pure tuberculous empyemas. Further classification is based on the condition of the lung underlying the empyema, as determined by sputum and x-ray examination. The two groups are those with adequate collapse, arrested disease and negative sputum and those with inadequate collapse and active tuberculosis. The four groups are designated by Roman numerals; Group I, pure tuberculous empyema with adequate collapse; Group II, mixed empyema with adequate collapse; Group III, pure tuberculous empyema with inadequate collapse and Group IV, mixed empyema with inadequate collapse.

TABLE II
Probable Etiological Factors in Tuberculous Empyema

| Group | Number of Cases | Simple Effusion | Spontan. Pneumo. | Therap. Pneumo. | Pneumono-lysis | Thoraco-plasty |
|-------|-----------------|-----------------|------------------|-----------------|----------------|----------------|
| I | 13 | 1 | 3 | 9 | 0 | 0 |
| II | 7 | 0 | 2 | 3 | 0 | 2 |
| III | 18 | 0 | 2 | 12 | 4 | 0 |
| IV | 23 | 1 | 5 | 10 | 6 | 1 |
| TOTAL | 61 | 2 | 12 | 34 | 10 | 3 |

The probable etiological factor of tuberculous empyema has been tabulated in Table II. In two patients, who entered the hospital with an effusion and later developed tuberculous empyema, a parenchymal lesion was demonstrated in one case. The largest number of patients developed tuberculous pus in the group with the inadequate collapse. This clearly demonstrates the danger of continuing an inadequate collapse by pneumothorax. Empyema developed particularly when positive pressure was used in an attempt to force closure of cavities in lungs with massive adhesions. Spontaneous pneumothorax was responsible for 12 cases of tuberculous empyema, and usually occurred in patients with far advanced disease. One patient developed an empyema following an open pneumonolysis, while in nine, it followed completed or attempted closed pneumonolysis. During thoracoplasty it happens occasionally that a tear occurs in the parietal pleura, particularly during the resection of the anterior portion of the ribs through a posterior incision. Such tears are repaired and only in a few instances lead to pleural effusion and empyema. Three patients developed this complication following thoracoplasty.

Skavlem⁴ of the Hamilton County Tuberculosis Hospital clearly demonstrated that caseous lesions, or rather the exudative and chronic fibroid lesions with exudate, were definitely a factor in the production of tuberculous empyema. Although hematogenous dissemination and infection of the pleural surfaces may occur, it is more probable that the pleural space becomes infected by direct extension of the tuberculous focus through the visceral pleura, or by lymphatic dissemination. The first occurs undoubtedly in patients developing a spontaneous pneumothorax, where a direct tear in the visceral pleura is the factor responsible for both the infection of the pleural space and the establishment of bronchial communication between the pleural space and the bronchial tree. During closed pneumonolysis we have observed tubercles on the visceral pleura on several occasions, while the parietal pleura was normal. These tubercles have their origin in the peripheral parenchyma of the lung and may rupture into the pleural space.

The incidence of tuberculous empyema following closed pneumonolysis appears high; however, when we consider the nature of these adhesions, it seems rather surprising that empyema does not occur more frequently. During pneumonolysis every attempt is made to cut as close to the parietal pleura as is possible, and we are not aware of ever having carried the section into a cavity, which occasionally extends into capstan adhesions. The high frequency current used in pneumonolysis coagulates the tissue next to the line of section. Bleeding is controlled by coagulation and

subsequent necrosis of tissues no doubt occurs. The necrotic tissue leads to sloughing in a relatively short time and opens both lymph and blood vessels, permitting entrance of tubercle bacilli into the pleural space. That tuberculous infection travels through the visceral and parietal pleuras by way of adhesions into the chest wall has been demonstrated.

The aerobes and anaerobes of the mixed infection enter the pleural space usually after the tuberculous empyema has become well established. Table III shows the complications of tuberculous empyema and indicates a frequent source of the secondary infection: bronchopleural fistula. Cutaneous fistulas usually occur along the needle tract of aspiration. They may occasionally extend through the parietal pleura, dissect through the chest wall and emerge externally some distance from the internal opening. Even though the needle puncture is made in different places, such cutaneous fistulas are frequently unavoidable.

The problem of treating tuberculous empyema is essentially that of obliterating the infected pleural space in the patients of groups I and II. In patients with inadequate collapse and empyema in addition to the above, the treatment must be directed toward closure of parenchymal cavities. In empyemas of short duration, before there has been marked thickening of the visceral pleura, re-expansion may occasionally be accomplished by frequent aspiration and removal of pus and air under high negative pressure. Also, with continuous intercostal suction using the Stedman pump or some other constant suction apparatus, even in the presence of a broncho-pleural fistula, we have obtained good results in several cases. However, in patients of groups I and II such re-expansion would discontinue the collapse of the lung. In group I cases oleothorax is used to obliterate the pleural space and at the same time maintain the collapse. In group II cases, who formerly required rib resection and tube drainage with subsequent thoracoplasty, many are now successfully converted to group I

TABLE III
Complications of Tuberculous Empyema

| | Number of Cases | Dead | End Results | | |
|------------------------|--------------------|------|-------------------|-------------------|------|
| | | | Residual Sinus | Active Disease | Well |
| Cutaneous Sinus | 4 | 2 | 2 | 0 | 0 |
| Bronchopleural Fistula | 17 | 15 | 1 | 0 | 1 |
| Mixed Infection | 30 | 18 | 0 | 3 | 9 |

TABLE IV
End Results of Different Types of Treatment Used in Tuberculous Emphysema

| Group | Aspiration and Irrigation | | | Oleothorax | | | Thoracoplasty | | |
|-------|---------------------------|----------------|--------|------------|----------------|----------|-----------------------|---------------|---------------------|
| | Dead | Active Disease | Well | Dead | Active Disease | Well | Came to Thoracoplasty | Operat. Death | Well Residual Sinus |
| I | 1 | 1 | 0 | 0 | 2 | 8 | 0 | 0 | 0 |
| II | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 |
| III | 7 | 1 | 0 | 1 | 1 | 2 | 1 | 0 | 1 |
| IV | 6 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 2 |
| TOTAL | 15 (83%) | 2 (11%) | 1 (6%) | 2 (10%) | 3 (15%) | 13 (65%) | 2 (10%) | 1 (12%) | 4 (50%) |
| | | | | | | | | | 3 (38%) |

TABLE V
End Results of Tuberculous Emphysema

| Group | Number of Cases | Alive but with Active Disease | | Well, with sinus | | Dead | Not Traced |
|-------|-----------------|-------------------------------|------------|------------------|----------|----------|------------|
| | | Well | Disease | Well | sinus | | |
| I | 13 | 3 | 8 | 0 | 0 | 2 | 0 |
| II | 7 | 0 | 2 | 1 | 4 | 4 | 0 |
| III | 18 | 2 | 6 | 1 | 8 | 8 | 1 |
| IV | 23 | 2 | 4 | 2 | 15 | 15 | 0 |
| TOTAL | 61 (100%) | 7 (11.5%) | 20 (32.5%) | 4 (6.5%) | 29 (49%) | 29 (49%) | 1 (1.5%) |

cases by the use of penicillin. Phrenic exeresis, as such, will not close an empyema space; however, when done early it will definitely reduce the size of the empyema cavity and in this manner make a later thoracoplasty less radical. Extrapleural thoracoplasty, followed by a Schede operation in patients with cutaneous or bronchopleural fistula is the procedure of choice in inadequate collapse of the lung and tuberculous empyema.

Table IV illustrates the results obtained in treating tuberculous empyema by aspiration and irrigation, oleothorax and surgical collapse. In comparing these results, we must bear in mind that no attempt was made to use controls and the treatment used in each case was that which promised to give the best results with the least radical procedure. It is obvious that oleothorax could not be tried in patients with bronchopleural fistulas or cutaneous sinus. On the other hand, patients with adequate collapse and pure tuberculous empyema, and usually in good general condition, were receiving oleothorax rather than the deforming thoracoplasty.

The patients treated by aspiration and irrigation for the most part had bilateral disease at the time of the development of their empyema and were in such poor general condition as to make surgical collapse out of the question. The high mortality rate in this group could possibly have been lowered by earlier surgical intervention. Aspiration in some was done only to make the patients more comfortable, particularly in those with bronchopleural fistulas. Irrigation and aspiration were used in patients belonging to Group I, but there was no change in the empyema, and tubercle bacilli could be recovered after long periods of this type of treatment. The instillation of germicidal solutions such as merthiolate, azochloramide and various dyes was of no more apparent benefit than the use of saline solution. Since 1942 we have used sodium sulfathiazole in a 5 per cent solution in several patients with mixed empyema, with the disappearance of the streptococci and staphylococci; however, this did not change the tuberculous empyema. More recently, with the use of penicillin the results have been most gratifying. However, none of these cases are included in this report.

The use of oleothorax was of particular benefit in the patients with an adequate collapse. Of the 12 cases so treated, 10 are well, while two have active disease in the contralateral lung and are still in the hospital. In two patients an inadequate collapse was made satisfactory; one died and one still has active disease. Two patients of Group III and IV were benefited by the oleothorax; however, they did eventually come to thoracoplasty. These Group III and IV patients were among early ones treated by oleothorax in an attempt to produce an adequate collapse. Having been proved

ineffectual in this type of case, this method of treatment has now been abandoned. We have at the present time two patients who have had an oleothorax for over seven years, and both are quite well and active. There has been a gradual but very slow re-expansion of the lung. One patient of our series developed a bronchopleural fistula and raised a small amount of oil. There have been no accidents due to drowning of the patients with oil from an oleothorax.

Surgical collapse is the procedure of choice in patients of Groups III and IV. Apical thoracoplasty with the removal of seven or more ribs, preceded by a phrenic evulsion, and followed by a Schede operation of the lower thorax in patients with cutaneous and bronchopleural fistulas will both obliterate the empyema space and close the tuberculous cavity. The thoracoplasty is performed in multiple stages and is more radical as compared with a thoracoplasty done for closure of cavity alone. Anterior stages are used and every attempt is made to prevent infection of the subscapular space, which leads to chronic draining sinuses and occasionally prevents completion of the operation.

In one patient of this group the mediastinum was apparently entered during the radical resection of the ribs, leading to the formation of an oesophageal-pleural-cutaneous sinus. This patient is still in the hospital and following treatment the sinus has now been closed. The mortality of surgical treatment of tuberculous empyema appears to be high; however, it should be used earlier and more frequently in patients with inadequate collapse and tuberculous empyema. This group carries an extremely high mortality without early surgical treatment.

In empyemas without cutaneous or bronchopleural fistulas, aspiration is carried on during the time of the thoracoplasty, and every attempt is made to keep the pleural space dry. However, when a broncho-pleural fistula is present, rib resection and open drainage should be carried on before the thoracoplasty is done since aspiration pneumonia was responsible for the one operative death in our series.

The recent use of penicillin in the treatment of acute empyema has greatly reduced both the morbidity and mortality of this disease. In patients with mixed tuberculous empyema and adequate collapse penicillin is now being used in our hospital with conversion of such empyemas into pure tuberculous empyemas in the majority of cases. The results obtained in patients with cutaneous and bronchopleural fistulas have not been as clear cut; however, several patients have greatly benefitted by the use of penicillin. Our over all mortality of 50 per cent in patients with

tuberculous empyema should definitely be reduced in the future with the aid of this new therapeutic agent.

The end results of the treatment of tuberculous empyema are presented in Table V. Of the 13 patients of Group I, three have active disease in the contralateral lung, eight are well and two are dead. Of the seven patients of Group II, two are well, one has a residual sinus with arrest of the tuberculosis, while four are dead. In Group III, two patients have active disease, seven are well, and eight are dead. The highest mortality was found in Group IV with fifteen out of twenty-three patients dead. Two are alive, but have active disease, and only six are well; two of these still having residual cutaneous sinuses.

CONCLUSION

The maintenance of inadequate collapse of the lung definitely increased the incidence of tuberculous empyema in patients with pulmonary tuberculosis.

When pneumothorax fails to produce adequate collapse, and pneumonolysis and phrenic nerve interruption have been unsuccessful, it should be discontinued at once and surgical collapse instituted.

In simple tuberculous empyemas with adequate collapse of the lung oleothorax appears to be the treatment of choice. In patients with mixed tuberculous empyema and adequate collapse, oleothorax should be instituted after the infection of the pleura has been converted into a pure tuberculous empyema. In patients with inadequate collapse of the lung and tuberculous empyema, surgical collapse is the only procedure which promises good end results.

Irrigation and aspiration alone have been of no apparent value on our experience in treating tuberculous empyema.

CONCLUSION

El mantenimiento del colapso inadecuado del pulmón definitivamente aumentó la frecuencia del empiema tuberculoso en pacientes con tuberculosis pulmonar.

Cuando el neumotórax no produce un colapso adecuado y han fracasado la neumonolisis y la frenicectomía, debe abandonarse inmediatamente este procedimiento y debe producirse el colapso quirúrgico.

En los empiemas tuberculosos simples con colapso adecuado del pulmón, el tratamiento de elección parece ser el oleotórax. En pacientes con empiema tuberculoso mixto y colapso adecuado, debe aplicarse el oleotórax después de que la infección de la pleura ha sido convertida en un empiema tuberculoso puro. En pacientes con colapso inadecuado del pulmón y empiema tuberculoso, el

colapso quirúrgico es el único procedimiento que promete buenos resultados finales.

En nuestra experiencia en el tratamiento de empiemas tuberculosos, la aspiración y la irrigación solas no han tenido valor aparente.

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The Treatment of Tuberculous Empyemas^{on} with Tyrothricin

J. M. DONALDSON, JR., M.D., F.C.C.P.,* and HEWELL C. SAMUEL, M.D.**
Sanatorium, Texas

Tuberculous empyema is a common and serious complication of pneumothorax therapy. Heaton¹ reports that the average incidence of empyema in the pneumothorax cases of twelve authors was eight per cent. Others² report 20 to 30 per cent in pneumothoraces complicated by pleural effusion.

Empyema usually results from the tearing of an adhesion into the lung, thereby involving areas of tuberculous infiltration or cavitation, or from rupture of pulmonary lesions into the pleural space due to progression of the disease. Furthermore, Brock et al.³ found that the degree of collapse of the lung materially effects the type of fluid that eventually develops. In 53 per cent of the unsatisfactorily collapsed cases effusion developed, while 38 per cent of the satisfactorily collapsed cases developed effusion. Of these 69 per cent became seropurulent or purulent when the lung was satisfactorily collapsed as compared to 85 per cent when the lung was unsatisfactorily collapsed.

Many substances have been used in an attempt to sterilize the empyema cavity. Among these the most important are azochloramid, metaphen, merthiolate,³ hexylresorcinol,² medicated oils,⁴ and quinine urea hydrochloride.⁵ Petroff and Herman⁶ have reported good results with bactericidal substances reinforced with wetting agents. Most investigators agree that when the empyema shows no response to aspiration and the instillation of bactericidal substances, thoracoplasty⁷ should be done. However, as in our cases, this procedure may not be applicable due to too extensive or progressive disease in the contralateral lung or poor general condition.

In 1939 Rene J. Dubos⁸ reported the results of his study of a natural bactericidal substance found in the aerobic spore forming soil bacterium, *Bacillus Brevis*. This extract, tyrothricin,[†] commonly called gramicidin consists of gramicidin, the bactericidal component, and tyrocidin which enhances the solubility and stability of gramicidin.

*San Antonio, Texas.

**Texas State Tuberculosis Sanatorium, Sanatorium, Texas.

†Tyrothricin was supplied through the courtesy of Parke, Davis, and Company in a two per cent alcoholic solution. Before using the solution it was diluted with distilled water, thus producing a milky suspension.

To determine whether tyrothricin, which has an affinity for gram-positive organisms, would favorably influence the course of tuberculous empyemas, the cases presented in this communication were aspirated as nearly dry as possible, lavaged with sterile distilled water and an aqueous suspension of tyrothricin was instilled into the pleural space and allowed to remain until the next aspiration. Distilled water was used to irrigate the pleural cavity rather than saline because the latter inactivates the active principle of tyrothricin.

CASE REPORTS

Case 1: Miss F. H., a white female 18 years of age entered the Texas State Sanatorium on October 19, 1941. She gave a history of having had a poor recovery from influenza in December of 1940. She continued to lose weight after December, to have malaise and loss of strength, and to cough. Hemoptysis occurred in July 1941. An x-ray of the chest on October 1, 1941 revealed the presence of pulmonary tuberculosis.

Physical examination upon entrance to the sanatorium showed medium and coarse rales over the right upper lobe with signs of cavitation in the same area. There were also medium and coarse rales over the left chest posteriorly from the apex to the level of the 7th thoracic spine. X-ray examination on October 20, 1941 showed bilateral upper lobe cavitation with an infiltration involving the right upper lobe and the entire left lung. The sputum was positive for tubercle bacilli.

Left artificial pneumothorax was begun on February 11, 1942. Apical adhesions prevented an effective collapse of the left lung and an intrapleural pneumonolysis was done on April 11, 1942, producing an effective collapse. Pulmonary hemorrhage began on May 1, 1942 and continued for almost a month, from one-half to three ounces of blood being raised daily. Right pneumothorax was instituted May 4, 1942. The patient had a spontaneous pneumothorax on the left on May 8, 1942 and air was aspirated from the pleural cavity for several days.

Exudate began to form in the left pleural cavity on June 6, 1942. On June 20, 775 cc. of cloudy fluid were aspirated. This fluid was positive upon concentration.

The patient continued a down hill course and was discharged on July 19, 1942 as unimproved. The sputum was positive III. She continued to receive refills on the right and to be aspirated on the left. A short time after leaving the sanatorium, she developed an empyema on the right. She returned to the clinic at irregular intervals to be aspirated and irrigated with azochloramid solution.

On July 13, 1943, 11 cc. of purulent fluid were removed from the left pleural cavity and following lavage with distilled water, 50 cc. of 100 mg. per cent tyrothricin were instilled. Eight hours after the aspiration the patient complained of pain in the left chest and the temperature was 104.2 and the pulse 160.

On July 27, 1943, 125 cc. of purulent fluid were removed from the left chest and 25 cc. of 100 mg. per cent tyrothricin were instilled. Following the injection the patient again complained of pain in the chest and had a high elevation of temperature. On August 10, 1943, 50 cc. of purulent fluid were removed from the right pleural cavity and 25 cc. of 50 mg.

per cent tyrothricin were injected, following which the patient again had fever and pain in the chest. Because of the severe reactions following the injection of tyrothricin, this method of treatment was discontinued.

Case 2: Mr. W. H. H., a white male, 21 years of age, entered the Texas State Sanatorium on May 25, 1942 with a diagnosis of far advanced B pulmonary tuberculosis. Physical examination revealed decreased fremitus over the left base and dullness in the same area. Breath sounds were also absent over the left base. The weight was 173; the temperature 100.2; and the pulse 112. X-ray examination showed a scattered infiltration over the right lung field. There was also a light infiltration involving lower half of the left lung with a cavity in the 4th and 5th anterior interspaces. The sputum was positive for tubercle bacilli. The intradermal coccidioidin test was positive in 48 hours.

Two days after entrance the patient had a spread of the disease to the right lower lobe. On May 29, 1942 he began to expectorate blood and continued to raise a few drams almost daily until June 9, 1942. On August 2, 1942 the patient complained of severe pain in the left side and a pleural exudate began to form. On October 8, 1942, 880 cc. of purulent fluid were removed from the left pleural cavity and a solution of azochloramid was used as lavage. He was aspirated at weekly intervals until his dismissal on February 25, 1943. The purulent fluid was positive for tubercle bacilli.

The x-ray at the time of discharge revealed an area of infiltration involving the right base. The left lung was almost completely collapsed in the lower two-thirds with the apex adherent to the chest wall. A small amount of fluid was present in the costo-phrenic angle.

The patient continued bed rest at home and returned to the clinic to be aspirated each week.

On July 13, 1943, following the aspiration of 50 cc. of purulent fluid, the pleural cavity was lavaged with distilled water and 50 cc. of 100 mg. per cent tyrothricin were instilled. For two days following the aspiration the patient had an elevation of temperature and pain in the chest. On July 20, 150 cc. of purulent fluid were removed from the left pleural space. Because of the severe reaction experienced from the previous instillation of tyrothricin, the dose was reduced to 25 cc. of 100 mg. per cent. No pain was experienced following this instillation, however, the temperature was elevated to 102.

Twenty-five cubic centimeters of 100 mg. per cent solution of tyrothricin were instilled at weekly intervals following aspiration and lavage until September 7, 1943. On September 7, and September 14, 50 cc. and 40 cc. respectively of 100 mg. per cent tyrothricin were instilled. The patient continued to have temperature of 101 to 102 following instillations of tyrothricin and the pleural exudate became thicker and difficult to aspirate. Therefore, the instillations of this drug were discontinued after 10 injections.

Case 3: Mr. A. H. N., a white male 23 years of age, entered the State Sanatorium on January 15, 1943 with a diagnosis of far advanced pulmonary tuberculosis. He had a rectal fistulectomy in October of 1942. His mother died of pulmonary tuberculosis at the age of 52 and his wife had been a patient at this sanatorium. The patient stated that he had been ill since an attack of influenza in November of 1942.

Physical examination of the chest revealed increased fremitus over the upper half of the right lung and dullness in the same area. Bronchophony and whispering pectoriloquy were elicited over the right apex. Crepitant rales were heard over the same area.

The x-ray showed an infiltration in the right upper lobe with a cavity one centimeter in diameter. There was also an area of infiltration in the left lung at the level of the 4th and 5th ribs anteriorly. The sputum was positive for tubercle bacilli.

Right artificial pneumothorax was begun on January 25, 1943. Due to pleural adhesions, the pneumothorax was ineffective and an intrapleural pneumonolysis was performed on February 3, 1943. Fluid began to form rapidly and 225 cc. were removed on April 27. Clear straw colored fluid was aspirated at weekly intervals in amounts of 250 cc. to 275 cc. which was negative for tubercle bacilli. On August 14, 1943 the fluid became purulent but was always negative for tubercle bacilli.

On August 17, 105 cc. of purulent fluid were removed from the right pleural space and after lavage 25 cc. of 50 mg. per cent tyrothricin were instilled. This procedure was repeated each week until the patient left against advice on September 3, 1943.

Following each instillation of tyrothricin the temperature went up to 100 to 101.6.

Case 4: Mr. J. U. C., a white male, 27 years of age, entered the Sanatorium on January 27, 1943. In December 1941 an army examination revealed the presence of pulmonary tuberculosis which was considered to be inactive. In August of 1942 the patient had an acute pulmonary episode that was diagnosed as influenza. In September of 1942 the sputum was found to be positive for tubercle bacilli and artificial pneumothorax was instituted upon the right.

Physical examination of the chest revealed the absence of breath sounds over the entire right side with occasional fine rales over the left apex. The x-ray showed the right lung to be partially collapsed at the base with the apex bound to the chest wall by numerous adhesions. A small amount of fluid was present in the right costo-phrenic angle. There was also a cavity in the right apex and a scattered infiltration throughout the left lung. The sputum was positive for tubercle bacilli upon concentration.

The pleural exudate increased and it became necessary to remove it on April 14, 1943. At this time the fluid was clear and negative for tubercle bacilli. On May 24, the exudate was found to be purulent and positive for tubercle bacilli. The patient was aspirated at weekly intervals and lavaged with a solution of azochloramid until July 13. On this date 100 cc. of purulent fluid were removed from the right pleural cavity. After lavage with distilled water, 50 cc. of 100 mg. per cent tyrothricin were instilled. A severe reaction followed the instillation of the tyrothricin; the temperature reaching 102. On the subsequent two instillations 25 cc. of 100 mg. per cent tyrothricin were injected. Because the temperature was elevated following each instillation and the patient complained of chest pain and nausea, the instillations of tyrothricin were discontinued.

Case 5: Mrs. J. O., a white female 18 years of age, entered the Sanatorium on February 16, 1943. The patient stated that she had not been well since the birth of her child in July of 1942. Physical examination

revealed dullness to percussion over the left upper lobe with bronchial breath sounds and many medium and coarse rales in the same area. There were also a few fine rales over the right apex posteriorly and over the right base laterally.

The x-ray showed a marked infiltration in the left upper lobe with multiple areas of cavitation. There was a small area of infiltration in the right apex. The sputum was positive for tubercle bacilli.

Left artificial pneumothorax was instituted on February 19, 1943. On April 6, the pneumothorax was abandoned because of numerous adhesions from the apical portion of the lung to the chest wall. Thoracoplasty was advised and the patient entered another hospital for this operation. While awaiting surgery the patient had a left spontaneous pneumothorax on May 5, 1943. A massive pleural effusion occurred which required frequent removal. On July 19, 1943 she returned to this institution and on July 26, aspiration of the pleural exudate revealed it to be purulent and it was positive for tubercle bacilli.

On August 5, 550 cc. of purulent fluid were removed and 25 cc. of 40 mg. per cent tyrothricin were injected. Weekly aspirations followed by the instillation of tyrothricin in amounts from 10 to 25 mg. were done until December 30, 1943. At that time injections of tyrothricin were discontinued for the patient had a high elevation of temperature following each aspiration and there seemed to be no favorable influence exerted upon the character nor the amount of the purulent exudate.

Aspiration followed by lavage with azochloramid solution and the instillation of azochloramid were done each week thereafter until her discharge on February 12, 1944. There was no temperature elevation following the use of azochloramid solution.

Case 6: Mr. P. T., a Mexican male, 39 years of age entered the Sanatorium on May 26, 1943. In August of 1942 he had an acute pleurisy with effusion. A diagnosis of pulmonary tuberculosis was made at that time. The left hemithorax was aspirated on several occasions. In January of 1942 the exudate became purulent and a portion of one rib was removed and a tube inserted. The tube was removed only a short time before the patient entered the institution.

Physical examination of the chest revealed two scars in the left mid-axillary line at the level of the 6th interspace. There was dullness to percussion over the upper half of the left lung with absent breath sounds in the same area. The sputum examination was negative for tubercle bacilli. Pottenger's concentration of the pleural exudate was negative for tubercle bacilli.

The x-ray showed a small pyo-pneumothorax over the left upper lobe with a thickened pleura. There was also a small area of infiltration in the second right interspace.

On July 13, 1943, 100 cc. of purulent fluid were removed from the left pleural space. After lavage 50 cc. of 100 mg. per cent tyrothricin were instilled. Eight hours after the instillation the patient's temperature was 102.8 and the pulse 120.

He left the sanatorium on July 15, 1943 against advice.

Case 7: Miss O. R., a Mexican female, 22 years old entered the Sanatorium on July 3, 1943. She gave a history of a severe chest cold in May of 1943. Her cough and fever continued and a diagnosis of pulmonary tuberculosis was made in June of 1943.

Physical examination revealed impaired resonance and many fine rales over the left upper lobe anteriorly and posteriorly. The x-ray examination showed a large cavity in the left upper lobe with a scattered infiltration throughout the left lung. There was a fine scattered infiltration in the right upper lobe. The sputum was positive for tubercle bacilli.

Left artificial pneumothorax was begun on July 7, 1943. Intrapleural pneumonolysis was done on August 26, 1943 to free the apex of the left lung. Pleural exudate began to form rapidly and on September 6, 280 cc. of clear fluid were removed from the left pleural space. The pleural exudate became purulent on October 7, and tubercle bacilli were found in the fluid one week later. The fluid was removed each week and the pleural space was irrigated with a solution of azochloramid. On November 4, 40 cc. of purulent exudate were removed and 10 mg. of tyrothricin were injected. At weekly intervals the pleural space was aspirated, irrigated with distilled water, and 10 to 15 mg. of tyrothricin were instilled. This was continued until the patient was discharged on April 3, 1944.

The character of the pleural exudate did not change during the treatment but the pleural space decreased in size due to partial reexpansion of the lung and displacement of the mediastinal contents to the left.

On March 18, 1944 the left phrenic nerve was crushed, to accomplish the following results: decrease the size of the pleural space, prevent complete reexpansion of the lung and reopening of the cavities, and prevent further displacement of the mediastinum with further cardiac embarrassment.

The patient had an elevation of temperature following each instillation of tyrothricin; the temperature varying from 99.2 to 101.8. Following aspirations with no tyrothricin instilled, there was no elevation of temperature.

Case 8: Mrs. A. G. S., a Mexican female, 31 years of age entered the State Sanatorium on January 10, 1944. She gave a history of having had pneumonia in 1941 followed by left pleural effusion which was aspirated at that time. The patient had another pulmonary episode which was diagnosed as pneumonia in December of 1943. Left pleural effusion again appeared and upon aspiration of this fluid, it was found to be purulent. She admitted upon questioning that she had had a cough since 1941. Her family history was negative.

Physical examination showed the patient to be toxic but well nourished. The percussion note over the left chest was flat and the breath sounds varied from distant in the upper chest to absent in the lower part. A few fine rales were present over the right apex. The temperature was 99; the sputum was positive.

X-ray examination revealed 90 per cent collapse of the left lung with a fluid level at the third costo-chondral junction. There was a fine scattered infiltration in the upper lobe of the right lung. The mediastinum was displaced to the right.

On January 13, 1944, 880 cc. of purulent fluid were removed from the left pleural space. Following lavage with distilled water, 10 cc. of 100 mg. per cent tyrothricin were left in the pleural cavity. This procedure was repeated at weekly intervals except on two occasions until the patient left against advice on March 11, 1944. On February 17 and March 2, the left pleural space was aspirated but no tyrothricin was injected.

Following each instillation of tyrothricin the patient had an eleva-

tion of temperature ranging from 99.6 to 102.2 and complained of pain in the chest. Following aspirations when no tyrothricin was instilled, there was no elevation of temperature. However, since the temperature was quite irregular between aspirations it cannot be stated positively that the instillation of tyrothricin was the sole cause of the elevation.

Although this series of patients is small and consequently no definite conclusions can be drawn, the following facts should be noted:

1. Tyrothricin instilled into the pleural cavity in amounts of 10 to 50 mg. cause an elevation of temperature.
2. Neither the character nor the amount of the purulent pleural exudate was altered by tyrothricin injections.

SUMMARY

Eight patients with tuberculous empyema were treated with tyrothricin in amounts varying from 10 to 50 mg. The temperature was elevated following the instillation of this drug in all cases. In three cases chest pain was experienced and one patient complained of dyspnea eight hours after the instillation of tyrothricin. Tyrothricin did not alter the character nor the amount of the purulent exudate.

RESUMEN

Se trató a ocho enfermos con empiema tuberculoso con tirotricina en cantidades que variaron de 10 a 50 mg. En todos los casos sobrevino hiperpirexia consecutiva a la instilación de esta droga. Tres casos sintieron dolor en el pecho y un enfermo se quejó de disnea ocho horas después de la instilación de tirotricina. La tirotricina no alteró ni el carácter ni la cantidad del exudado purulento.

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Tuberculous Empyema Treated with Vitamin A - D Concentrate (A Preliminary Report)

WALTER RAAB, M.D.*
Glenn Dale, Maryland

In 1934 Lohr¹ reported the external use of cod liver oil in the treatment of skin wounds. Recently, "A Status Report on the External Use of Cod Liver Oil"² summarized the Literature. Many other conditions have also been treated according to the same principles. To this subject we would like to add the following:

We proceeded to inject *intra-pleurally*, considering it as a topical application, a Vitamin A-D concentrate.**

Material and Method:

We selected six cases of tuberculous empyema complicating artificial pneumothorax; all were failures of the conventional conservative therapy, *i.e.*, aspirations and lavage with antiseptic solutions. The general condition in all cases was too poor to warrant any surgery. Most had fever, loss of weight, and poor appetite. Five of the cases had had for several months draining, *cutaneo-pleural* sinuses. These followed the needle tracks of previous aspirations.

In two of these cases the empyema threatened to break through the skin (Empyema Necessitatis). The chest fluid was purulent in five out of the six cases and all had remained positive on smears as well as on cultures from six months to four years. In one instance there was a mixed infection with B. Aerogenous.

Five cc. to 8 cc. of Vitamin A-D concentrate, sterilized, were intrapleurally injected once a week. In the course of the treatment the fluid was never aspirated more than once a week, as it accumulated, or for diagnostic purposes. All specimens were examined for tubercle bacilli by concentration and culture, as well as for pyogenic organisms.

Results:

Most apparent was local improvement followed by general well being, then changes in the fluid's appearance. Locally, the draining sinuses closed, and in a few days a scab formed. This scab was

*Glenn Dale Sanatorium, District of Columbia Health Department.

**Vi-Delta, Lederle.

replaced later by a fine scar; and the *empyema necessitatis* disappeared. The general condition improved. The temperature returned to normal. The appetite was regained, and some of the patients spoke of craving food for the first time since being taken ill. Morning nausea and vomiting of two of the sickest patients stopped, and most of them gained weight.

The consistency of the chest fluid changed in a few weeks from thick purulent to semi-purulent and later on to slightly turbid in appearance. Microscopically the fluid showed a considerable increase of cells (leucocytes). Tubercle bacilli which were present in all cases on smear and cultures before treatment, were not demonstratable on smear in five out of the six cases after three or four weeks of treatment. However in some of these cases the cultures remained positive for some time.

In one instance where the chest fluid still remained positive, the tubercle bacilli count considerably decreased.

CASE REPORTS

Case No. I: M. L. J., 34 years old, colored, female. Admitted 1/6/43 with history of pulmonary tuberculosis since December 1942; right lung, caseouspneumonic disease with positive sputum; right pneumothorax initiated 4/2/43; pneumolysis 4/20/43; chest fluid positive for tubercle bacilli on culture 5/24/43; also positive on direct smear 6/26/43.

Despite frequent aspirations and lavage with Azochloramid, fluid remained positive for tubercle bacilli; fever and loss of weight continued.

Vitamin A-D concentrate was first given intrapleurally 9/22/44. Patient gained 4½ pounds during first month of treatment. Temperature returned to normal within two weeks. The *empyema necessitatis* disappeared. Oxygen lavage to re-expand the lung was done twice in November 1944 with unfavorable results; viz., increase of fluid and re-appearance of bacilli on smear and luxurious growth on culture. The lung did not re-expand. Further vitamin therapy improved the patient again.

Case No. II: E. C., 32 years old, colored, female. Admitted 8/19/43, with caseous pneumonic disease of left upper lobe; sputum positive; left pneumothorax initiated 8/26/43; fluid on right side 1/6/44; fluid on left side positive for tubercle bacilli on culture 1/20/44; vitamin A-D concentrate given intrapleurally since 12/4/44. Chest fluid negative since 12/14/44.

Case No. III: L. W., 22 years old, colored, female. Admitted 6/20/42, with cavity in hilar region of left lung; sputum positive, Gaffky 5, on direct smear; left empyema positive for tubercle bacilli on direct smear 4/25/44. Frequent aspiration and lavage with Azochloramid; fluid remained positive with multiple draining, needle track sinuses since June 1944; vitamin A-D concentrate injections initiated 11/22/44 followed by closing of the sinuses in a few days. The fluid turned negative within three weeks, and has remained so since.

Case No. IV: A. S., 17 years old, colored, female. Admitted 8/31/43, with caseous pneumonic disease left upper lobe; sputum positive; left

pneumothorax 9/15/43; chest fluid positive for tubercle bacilli, Gaffky 3, 12/17/43; *Bacillus Aerogenus* found in chest fluid 9/26/44; treatment with Azochloramid lavage unsuccessful. Vitamin A-D concentrate initiated 10/16/44; patient's general and local conditions improved, and fluid turned negative for tubercle bacilli. Sinuses closed. Oxygen lavage caused set-back, and thoracotomy became necessary 12/18/44, however, patient's general condition was good and has been since. Vitamin A-D concentrate has been intrapleurally applied continuously since 10/16/44.

Case No. V: G. C., 21 years old, white, male. Admitted 10/6/42, with bilateral disease; caseouspneumonic, with cavity in left upper lobe; positive sputum; left pneumothorax discontinued because of unsatisfactory collapse. Right pneumothorax 6/16/43; fluid on right side positive for tubercle bacilli on culture 2/28/44; fluid positive on direct smear, Gaffky 8, 9/7/44; draining needle track sinuses after aspiration and lavage. Vitamin A-D concentrate injections initiated 10/19/44 with closing of sinuses in a few days. Empyema necessitatis disappeared; appetite improved; fever returned to normal despite active disease on left. Fluid continued positive for tubercle bacilli, but decreased in count.

Case No. VI: J. L., 44 years old, white, male. Admitted 6/1/43, with history of tuberculosis since 1940. On this re-admission, his right pneumothorax was complicated with tuberculous empyema (fluid positive). The sputum was also positive. Aspiration and lavage with Azochloramid unsuccessful. Rib resection and closed drainage 11/5/43; this was followed by an open drainage. The wound closed spontaneously 6/13/44. Chest fluid remained positive. Vitamin A-D injections initiated 11/18/44. Chest fluid turned negative within three weeks after beginning of Vitamin therapy.

DISCUSSION

The local effects of the treatment with the Vitamin A-D concentrate which were most readily noticeable were the closed sinuses, the changed appearance of the chest fluid and its increased number of leucocytes. All this concurs with the observations of other workers who applied cod liver oil locally, and who reported that such treatment resulted in "a definite leucocytic response with rapid liquefaction of necrotic material . . . with rapid healing and minimal scarring."²

The general improvement of the patients could be explained partly as a result of the local improvement, and partly because of a possible absorption of the vitamins. However, this is purely speculative as we were not able to do any vitamin assays.

Since the tubercle bacilli content of the fluids was changed, the question was raised whether or not the vitamin concentrate was bacteriostatic and bactericidal. Also in the one case of mixed infection with *B. Aerogenus* a similar impression was given. Lohr and Treusch believed cod liver oil to possess bacteriostatic and bactericidal properties.² Our attempts to prove such in vitro with tubercle bacilli have so far been unsuccessful, although investigation continues.

The dosage was from 5 cc. to 8 cc. of Vitamin A-D concentrate administered once a week. The dose was varied according to the patient's general and local conditions, the higher dose being given in the more severe cases. We do not know, as yet, the *minimum* or *optimum* dose; further studies are needed to determine this, and also the length of the treatment. We feel that this therapy should be continued long after the fluid is negative for tubercle bacilli, and as long as the fluid is re-forming; until by these criteria and others the empyema can be considered as cured.

We might mention that the impression is given that a decrease in the amount of the fluid—as shown by some of our cases over a five month period of observation—was due to the application of Vitamin A-D concentrate.

SUMMARY

1. Six cases of tuberculous empyema, complicating artificial pneumothorax, and unsuccessfully treated by the conservative method of aspirations and lavage, were given intrapleural injections of a vitamin A-D concentrate.
2. The results were local improvement, general improvement, and some changes in the tubercle bacilli content.
3. No attempt is made to draw a definite conclusion as to the specificity of this treatment, but further investigations are suggested.

RESUMEN

1. Seis casos de empiema tuberculoso, secundario al neumotórax artificial, y tratados sin éxito con el método conservador de aspiraciones y lavados, recibieron inyecciones intrapleurales de un producto concentrado de vitaminas A y D.
2. Los resultados obtenidos fueron: mejoría local, mejoría general y algunas alteraciones en el contenido de bacilos tuberculosos.
3. No se intenta sacar definidas conclusiones en cuanto a lo específico de este tratamiento, pero se sugiere las investigaciones adicionales.

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EDITORIAL

Chemotherapy in Tuberculosis

Chemotherapy in tuberculosis was revived when the sulfonamides were found to be efficacious in controlling certain infections. Although none of these preparations proved of value in the treatment of tuberculosis, another group of compounds known as sulfones was employed by Feldman, Hinshaw, Pfuetze, Petter, Medlar and others.^{1,2,3,4} The three most extensively used drugs in this group are known as promin, diasone and promizole. The immediate effect of these preparations on experimental tuberculosis was remarkable. However, further observations revealed that they apparently only suppressed the disease, since sensitivity to tuberculin was not lost in any treated animal. Moreover, in animals apparently successfully treated for a prolonged period the disease reactivated and caused death after medication was stopped. The same sulfone derivatives were administered for tuberculosis in humans but while some apparently encouraging results were observed, none proved entirely adequate.

When penicillin was found to be so effective in destroying certain infections it was immediately used in tuberculosis in animals and humans, but it proved to be of no avail. Recently another antibiotic substance, streptomycin, made from the organism *actinomyces griseus*, has been found to exert impressive effects in vitro and in vivo against the tubercle bacillus. Feldman, Hinshaw and Mann^{5,6} found streptomycin is effective in resolving or suppressing established experimental tuberculous infection in guinea pigs. In most instances the drug exerted a suppressive rather than a sterilizing effect; however, in approximately 39 per cent of the animals successfully treated the sensitivity to tuberculin disappeared, thus suggesting that a germicidal effect was exerted. Moreover, these animals were found to be sufficiently free from tubercle bacilli that the organisms could not be detected by the most delicate means of study; namely, infection of other guinea pigs with emulsions from the spleen. This suggests to Feldman and Hinshaw that if sufficient doses of streptomycin are administered for an adequate length of time to guinea pigs, actual sterilization may not be an impossible goal. The authors reported that the streptomycin preparations used had a low toxicity for guinea pigs in doses of 6000 units per day and were tolerated without recognizable deleterious effects for a prolonged period.

Smith and McClosky⁷ treated a group of tuberculous guinea pigs with promin and another group with streptomycin and reported

that streptomycin has a chemotherapeutic index better than ten times that of promin. When they used a suitable combination of streptomycin and promin they obtained results which under their experimental conditions they had not obtained previously.

A preliminary report of a study of the effects of streptomycin on tuberculosis in humans by Hinshaw and Feldman⁸ is encouraging. Thirty-four patients who had tuberculosis were treated with streptomycin over varying periods of time, with subsequent observation for periods up to nine months. It appeared probable that the drug exerted a limited suppressive effect, especially upon some of the more unusual types of pulmonary and extrapulmonary tuberculosis. No convincing evidence of rapidly effective bacteriocidal action was obtained. However, apparently significant improvement was seen in cases of early and extensive hematogenous forms of pulmonary tuberculosis, early miliary disease, tuberculosis of the genito-urinary tract and suppurative tuberculous lymphadenitis.

Any drug capable of destroying tubercle bacilli in the human body will be most effective if administered soon after the initial invasion occurs. Periodic tuberculin testing of uninfected individuals, which now constitute the majority in this country, will detect primary tuberculosis if it develops with almost 100 per cent accuracy within eight weeks after tubercle bacilli are focalized. Then and for some time thereafter one might expect to destroy all tubercle bacilli with a satisfactory chemotherapeutic agent. Thus the disease could be cured in the strict sense of the word before it has caused significant destruction of tissues. The only criterion of such cure would be the complete loss of allergy to tuberculo-protein, as indicated by subsequent tuberculin tests.

J. A. M.

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President's New Year Message

Nineteen Forty-Five apparently brought the end of hostilities in the second World War. However, in the wake of the war lay a ghastly sight. Contagious diseases are unleashed. Institutions, particularly sanatoriums for the tuberculous, were abandoned in an appreciable number of countries. Individuals with contagious tuberculosis volunteered or were forced to work, associating with large numbers of persons among whom they left a trail of the disease. Politicians, who sometimes are ignorant of the true values in human life, ordered cessation of hostilities against man's greatest enemies and demanded that man fight man, and thus become allied with the ever-present destroyers of mankind.

Before the war tuberculosis caused more incapacity and death throughout the world than any other disease, except in the occasional year, when it was surpassed by malaria. Throughout the war there was no year when as much incapacity and death resulted from the war per se as occurred the same year from tuberculosis. To have the clock of tuberculosis set back a quarter of a century is exceedingly discouraging. Although an extremely serious situation has been created, we must become reconciled and attack the problem energetically. Fortunately the knowledge which accrued in the past twenty-five years has not been destroyed. It is available for immediate use. This, together with new knowledge which we are sure to gain, should enable us to overcome our losses more rapidly than would have been possible at any previous time.

The United States was a favored nation from the standpoint of tuberculosis control throughout the period of the war because the mainland was never attacked or invaded by armies or suffered destruction from bombs of any type. Therefore, our efforts against tuberculosis were only slightly retarded; indeed, in some respects they were accentuated. The mortality rate decreased each year, reaching the all-time low of approximately 38 per 100,000 in 1945.

In general, it may be said that mortality from tuberculosis is the result of infections which occurred long ago. Therefore, our constant decrease in mortality was largely the result of the prevention of infections and reinfections years before the war. Likewise, the present mortality rate is no indication that tuberculosis in the United States was not markedly increased by the war. Certainly no one doubts that a much greater infection attack rate occurred among those who were sent overseas to nations where contagious tuberculosis is rife than among those who remained at home. Not enough time has elapsed for the disease to evolve to such proportions as to be significantly reflected in morbidity and mortality. The only possible hope of preventing this destruction

lies in the development of a specific chemotherapeutic agent which is capable of destroying all tubercle bacilli in the human body. While this is being perfected we must gird ourselves to reduce morbidity and mortality as much as possible, and above all to control contagion. In addition to those who were infected and re-infected in military service, there is a much larger number of civilians throughout the world, among whom tuberculosis is maturing. They must have the same consideration as those who were in military service.

Besides tuberculosis, a number of diseases which may at least temporarily involve the chest were contracted and widely disseminated by those in military service. Therefore, chest physicians everywhere must be on the look-out for such conditions as psittacosis, typhus fever, tsutsugamushi, amoebiasis, kala-azar, malaria, paragonimiasis and schistosomiasis.

War medicine taught us how to better evaluate some diagnostic procedures and how to treat certain chest conditions more effectively than ever before. The year 1945 brought us nearer to a specific chemotherapeutic agent for tuberculosis. Only continued hard work and time will tell whether streptomycin is this drug. In any event, for the first time we have learned to control experimental tuberculosis. The work of Palmer and others on histoplasmosis was outstanding and emphasizes the great importance of specific tests for accuracy of diagnosis whenever x-ray shadows are involved. The extensive tuberculosis control program launched by the Division of Tuberculosis of the United States Public Health Service has already accomplished much and offers great promise for the future. Lifting the ban on medical conventions will enable physicians everywhere to gain and give important information.

Despite handicaps incident to the war, the American College of Chest Physicians made numerous fine accomplishments through such councils as those on undergraduate and postgraduate medical education and Pan American affairs. Its activity in promoting appointments of committees on tuberculosis in state and county medical societies is outstanding. The increase in membership, with twenty-four Chapters and members in twenty-five nations affords much momentum for the medical campaign against diseases of the chest.

Thus, we are entering the year 1946 better informed, better equipped, and with a stronger will than ever before to solve the difficult problems which cause so much unhappiness, disability and untimely death among people everywhere. With these advantages, an innate desire to be helpful, a giving spirit and a determination to succeed, we shall move nearer the ultimate goal.

Jay Arthur Myers, M.D., F.C.C.P.

College News

ANNOUNCEMENT

The 12th Annual Meeting of the American College of Chest Physicians will be held at the Sir Francis Drake Hotel, San Francisco, California, June 28-29, July 1-2, 1946. The American Medical Association will meet at San Francisco, July 1-5, 1946. If you plan on attending the meeting, please arrange for your hotel accommodations *promptly*.

Harry C. Warren, M.D., F.C.C.P.
384 Post Street, San Francisco
Chairman, Arrangements Committee

BOARD OF REGENTS MEETING

The Semi-Annual Meeting of the Board of Regents of the American College of Chest Physicians was held at the Hotel Gibson, Cincinnati, November 11, 1945. The following Board members, committee chairmen and invited guests attended the meeting:

Dr. Carl C. Aven, Atlanta, Georgia
Dr. Andrew L. Banyai, Milwaukee, Wisconsin
Dr. Benjamin L. Brock, Waverly Hills, Kentucky
Captain Robert E. Duncan, Bethesda, Maryland
Dr. Charles J. Farrell, Covington, Kentucky
Dr. Alvis E. Greer, Houston, Texas
Dr. Edward W. Hayes, Monrovia, California
Dr. Charles M. Hendricks, El Paso, Texas
Dr. William A. Hudson, Detroit, Michigan
Dr. Chevalier L. Jackson, Philadelphia, Pa.
Dr. Minas Joannides, Chicago, Illinois
Major General S. U. Marietta, Washington, D. C.
Dr. Louis Mark, Columbus, Ohio
Dr. Jay Arthur Myers, Minneapolis, Minnesota
Dr. Richard H. Overholt, Brookline, Massachusetts
Dr. J. Winthrop Peabody, Washington, D. C.
Dr. Joseph C. Placak, Cleveland, Ohio*
Dr. Karl Schaffle, Asheville, North Carolina
Dr. H. I. Spector, St. Louis, Missouri
Dr. Nelson W. Strohm, Buffalo, New York
Dr. James H. Stygall, Indianapolis, Indiana
Dr. Walter E. Vest, Huntington, West Virginia
Dr. Paul A. Turner, Louisville, Kentucky
Mr. Murray Kornfeld, Chicago, Illinois

**Chairman, Board of Regents, presiding.*

Membership Committee

Captain Robert E. Duncan, Bethesda, Maryland, Chairman of the Membership Committee, reported 1816 members as of November 1, 1945, and 38 applications pending. This was an increase of 50 members since the annual meeting of the Board held on June 6, 1945. On November 1, there were still 409 College members serving with the Armed Forces of which 312 were in the Army and 97 in the Navy.

Board of Examiners

Dr. H. I. Spector, St. Louis, Missouri, Chairman of the Board of Examiners, introduced the following resolution:

The Board of Examiners feels that because of war conditions and other extenuating circumstances, the written examination was the only method available to the Board for the examining of candidates for Fellowship in the College. The Board recognizes that there should be an oral, as well as a written examination, in order to properly evaluate the qualifications of the candidates.

THEREFORE, BE IT RESOLVED, That the Board of Examiners of the American College of Chest Physicians be authorized by the Board of Regents to examine all future candidates for Fellowship in the College by oral as well as written examination.

The above resolution was unanimously adopted by the Board of Regents.

Council on Undergraduate Medical Education

The Council on Undergraduate Medical Education, with Dr. E. W. Hayes, Monrovia, California, Chairman of the Council presiding, held a meeting at the Hotel Gibson on the morning of November 11 to discuss the book entitled "The Fundamentals of Pulmonary Tuberculosis and Its Complications (For the Student, the Teacher, and the Practicing Physician)," being sponsored by the Council. It was announced that the book will be published by Charles C. Thomas, Publisher, Springfield, Illinois, and it is hoped that it will be available in 1946. Dr. Hayes and his Council were praised by the Board of Regents for the tremendous amount of effort which has gone into the preparations for the publishing of this important book.

Council on Postgraduate Medical Education

Dr. J. Winthrop Peabody, Washington, D. C., Chairman of the Council, presented an outline for a postgraduate course in diseases of the chest which was prepared by the Committee on Medical Education of the Illinois Chapter of the College. This outline was approved and the members of the Board of Regents were urged to study the plan and keep in touch with the progress made by the Illinois Chapter in sponsoring postgraduate medical education in chest diseases.

Committee on the College Award

Dr. Charles M. Hendricks, El Paso, Texas, Chairman of the Committee on the College Award, presented the following report:

On June 17, 1945, the Board of Regents established the College Medal to be officially presented to a Fellow of the American College of Chest Physicians, annually if feasible, by the College for some meritorious service in furthering progress in the field of Diseases of the Chest.

I.

- (a) Meritorious service in the field of Diseases of the Chest shall be interpreted as follows: All subjects which have a direct bearing on the advancement in the diagnosis, treatment, and control of all Diseases of the Chest, either by the application of clinical science, education, improved socio-economic conditions or a particular contribution to the College of Chest Physicians, whereby the College may improve its services to its Fellow and the public welfare;
- (b) The work upon which this is based must have been done in whole or in part either in the United States or any other country where a representative, active chapter of the College exists;

II.

The work shall be administered under the supervision of the Board of Regents by a "Committee on College Awards," consisting of five members appointed by the President, with the provision that no less than two and no more than three members shall be appointed each year;

III.

- (a) The Committee may appoint Fellows of the College, in reasonable number, who shall each maintain a close contact with a particular field of the realm of Diseases of the Chest and shall report to the Committee any special meritorious work which has been accomplished in this field;
- (b) If considered necessary the Committee may appoint a small Board of Referees to visit a Fellow of the College and investigate his work, in order to furnish the Committee with a first-hand opinion as to the merit of his work;
- (c) The Committee, after a complete survey of all reports, may select a recipient or recipients for the Award and should inform the President of the College of its choice at least sixty days prior to the annual meeting;
- (d) The College reserves the right to make no award if a sufficiently meritorious piece of work has not been recommended;

IV.

- (a) If the recipient of the College Award has been chosen because of a purely scientific contribution to the field of Diseases of the Chest, he shall file a written treatise on his work with the College and present the results in a paper before the annual session;
- (b) If the recipient is chosen for meritorious work in some other field than pure science, he will submit a resume of his particular work and file same with the College and present the resume before the annual session;
- (c) In either case, the President of the College will officially present the Award to the recipient immediately following the presentation of such treatise or resume.

The above report was unanimously adopted by the Board of Regents.

Council on Sanatorium Standards and Administration

Dr. Benjamin L. Brock, Waverly Hills, Kentucky, Chairman of the Council, reported that the Council had completed its plans for the organization of a Conference of Medical Directors of Sanatoria to be held in connection with the next annual meeting of the College. It was announced that Dr. J. Winthrop Peabody, Washington, D. C., will be the guest speaker at the Conference.

National Council of Tuberculosis Committees

Dr. James H. Stygall, Indianapolis, Indiana, Chairman of the Council, made the following report:

The National Council of Tuberculosis Committees wishes to go on record as congratulating the State of Minnesota upon carrying out the objective of our council by establishing a tuberculosis committee in every county medical society in their state. This project was carried out by

the State Tuberculosis Committee, of which our President, Dr. Jay Arthur Myers, is the Chairman.

A meeting of the chairmen of the county tuberculosis committees in the state was held at Minneapolis on October 26 and the minutes of the meeting are being prepared and a copy of same will be filed with the Executive Secretary of the College.

It is the opinion of our Council that this plan of organization be followed by all of the other states and we urge the state tuberculosis committees to take the lead in establishing this type of organization with the least possible delay.

It is recommended that the chairmen of the state tuberculosis committees send the names of the members of the county tuberculosis committees to the Executive Offices of the College so that these physicians may receive literature and other communications pertaining to the activities of the National Council of Tuberculosis Committees.

Our Council is of the opinion that the chairmen and members of the tuberculosis committees in the state and county medical societies should be invited to attend the annual meetings of the American College of Chest Physicians and in order to facilitate this project, the National Council of Tuberculosis Committees submits the following proposal:

BE IT RESOLVED, That a Conference of Tuberculosis Committees be sponsored by the National Council of Tuberculosis Committees of the American College of Chest Physicians and that this Conference meet at the annual meetings of the College. The Conference shall elect a chairman and secretary and the chairman shall appoint such committees which are necessary to conduct the program of the Conference. No official action shall be taken by the Conference which will be binding upon the American College of Chest Physicians unless such proposals are first submitted in writing to the Board of Regents of the College and favorably acted upon.

The above report was unanimously adopted by the Board of Regents.

Conference of College Chapter Officials

Dr. Alvis E. Greer, Houston, Texas, Chairman of the Conference of College Chapter Officials, presented the following report which was unanimously adopted by the Board of Regents:

With the termination of hostilities, the College chapters in this country are resuming their normal activities and most of the chapters are arranging meetings to be held with their state and district medical societies. All of the chapters have been encouraged to organize scientific program committees and it is hoped that these committees will communicate with the medical societies and arrange for places on the program so that interesting papers on diseases of the chest may be presented by competent speakers.

The chapters have also been requested to set up committees on medical education to work with the national Councils on Undergraduate and Postgraduate Medical Education. These committees are being asked to keep in contact with the deans and heads of departments in the medical schools in order to stimulate their interest in improving the teaching of tuberculosis and other chest diseases in our medical schools. They are also being asked to further the postgraduate teaching of chest diseases and to stimulate postgraduate teaching programs in their respective states and districts.

The third committee is the membership committee and every chapter has been urged to appoint a membership committee which will cooperate with the national Membership Committee of the College in assisting them to bring into the College, physicians who have the necessary qualifications for membership.

The Conference of College Chapter Officials will meet as before at the time of the annual meeting of the College. A program will be arranged in cooperation with the Scientific Program Committee of the College and will be presented at that time.

There are 18 College chapters in the United States and additional chapters will be organized when necessary, to keep in step with the growth of the College membership.

Ways and Means Committee

Dr. J. Winthrop Peabody, Washington, D. C., Chairman of the Ways and Means Committee, reported that copies of a specially prepared pamphlet urging the College members to support the advertising program of the College journal, "Diseases of the Chest," were mailed to every member of the College in the United States. Copies of the pamphlet were also mailed to the present advertisers and to a selected group of prospective advertisers urging that they support the College journal. Dr. Peabody again stressed the need for additional advertising revenue for the journal with the ultimate hope that the journal will become self-supporting so that the funds now being used to subsidize the journal may be used for other worthwhile College activities. The members of the Board of Regents pledged to support the Ways and Means Committee in this essential activity and every member of the College is urged to cooperate with the Committee in helping to secure additional advertising for the journal.

Committee on State Laws for Tuberculosis

Dr. Andrew L. Banyai, Milwaukee, Wisconsin, Chairman of the Committee, reported that the state laws for tuberculosis in the United States have been abstracted by his Committee and he proposed that they be printed and made available for distribution to interested parties. This proposal was adopted by the Board of Regents and the abstracts of the laws will be printed at an early date.

Scientific Program Committee

Dr. Minas Joannides, Chicago, Illinois, Chairman of the Scientific Program Committee, outlined the tentative program which the Committee has agreed upon for the 12th Annual Meeting of the College to be held at San Francisco, June 29-30, July 1-2, 1946. The outline of the program as presented by Dr. Joannides was approved by the Board of Regents. Colonel John B. Grow, Denver, Colorado, was appointed to replace Dr. Ralph C. Matson (deceased) on the Committee. The third member of the Committee is Major General S. U. Marietta, Washington, D. C.

Committee to Establish a Board of Diseases of the Chest

Dr. J. Winthrop Peabody, Washington, D. C., Chairman of the Committee, brought to the attention of the Board of Regents the numerous resolutions adopted by the College Chapters throughout the United States urging that the College take immediate steps to sponsor the

organization of a Board of Diseases of the Chest, and that such a Board be accorded equal status as the other recognized specialty boards. The following resolution was presented and unanimously adopted:

Pursuant to the many requests which have come before the committee appointed by the College to study the establishing of a Board of Diseases of the Chest, and in view of the resolutions adopted by the College chapters throughout the country urging that the Board of Regents of the College take the necessary steps to formulate such a Board, and in order that our committee may proceed with these directives with the least possible delay, it is proposed by this committee that the President of the College augment the personnel of the committee by inviting those members of the College who are certified by recognized Boards, to serve as members of our committee. It is further proposed that this committee, when fully organized, shall sponsor a questionnaire to be mailed to every chest specialist in the United States, irrespective of whether or not he is a member of any of the existing societies in this specialty, to ascertain the individual opinions of these physicians concerning the establishing of a Board of Diseases of the Chest. And, be it further proposed, that this work be undertaken with the cooperation of the Executive Offices of the College, but as a project independent of the American College of Chest Physicians.

A complete report of the Committee was published in the September-October, 1945, issue of "Diseases of the Chest."

Committee on Foreign Affairs

A special committee comprising Dr. J. C. Placak, Cleveland, Ohio, Chairman of the Board of Regents, Captain Robert E. Duncan, Bethesda, Maryland, Chairman of the Membership Committee, and Dr. Chevalier L. Jackson, Philadelphia, Pennsylvania, Chairman of the Council on Pan American Affairs, met at the Hotel Gibson, the morning of November 11, 1945, to discuss the College program in countries other than the United States of America. A number of proposals to strengthen the College membership and assist in the organization of College Chapters in other countries were advanced and approved by the Board of Regents of the College. It was further proposed that a Council on European Affairs and a Council on Pan Pacific Affairs be organized to function in the same manner as the Council on Pan American Affairs of the College. Dr. Andrew L. Banyai, Milwaukee, Wisconsin, was appointed Chairman of the Council on European Affairs and the following members of the College were appointed to serve on this Council:

Captain Robert E. Duncan, Bethesda, Maryland
Dr. Chevalier L. Jackson, Philadelphia, Pa.
Dr. Herman E. Hilleboe, Washington, D. C.
Dr. Minas Joannides, Chicago, Illinois
Dr. A. A. Leonidoff, Poughkeepsie, N. Y.
Major General S. U. Marietta, Washington, D. C.
Dr. J. C. Placak, Cleveland, Ohio
Dr. Hugo Polderman, Waverly Hills, Kentucky
Dr. Hilary Roche, Montana, Switzerland
Dr. Luis Saye, Buenos Aires, Argentina
Dr. Carl B. Semb, Oslo, Norway
Dr. H. I. Spector, St. Louis, Missouri
Dr. Peter A. Theodos, UNRRA, Greece

The appointment of the members of the Pan Pacific Council will be announced in a later issue of the journal. The chairmen of the three Councils will comprise the Committee on Foreign Affairs.

Resolutions

The following resolutions were adopted by the Board of Regents:

The last directory of College membership was published in 1943. The Board of Regents ruled that because of the war, the publication of the College directory be discontinued until further notice. Be it resolved, that the Board of Regents authorize the resumption of the publication of the College Directory for the year 1946, and that the President appoint a committee to supervise its publication.

Executive Council

During the past five years, the American College of Chest Physicians has tripled its membership, and many new councils and committees have been added. Because of this unprecedented growth of the College membership, and the resulting additional activities, it is recommended that the staff at the Executive Offices be increased. Be it resolved, that the present budget for the fiscal year ending April 30, 1946, be increased in the amount of \$1,000.00 for the employment of additional personnel at the Executive Offices of the College.

Executive Council

At the semi-annual meeting of the Board of Regents of the American College of Chest Physicians held at St. Louis on November 13, 1944, a resolution was adopted by the Board to change the terminology of "Associate Fellow" to read "Junior Fellow" and "Associate Member" to read "Affiliate." The College, over a period of years, has solicited membership under the present classifications in many countries and it would be confusing to the membership to change the terminology which has been so widely accepted in all of the countries. After further study and after consultation with the Executive Secretary of the College, it is our opinion that this change in terminology is inadvisable at this time. Therefore, I propose that the resolution which I introduced on November 13, 1944 relating to the above-mentioned proposal be withdrawn.

Charles M. Hendricks, M.D.

1946 COLLEGE DIRECTORY

In compliance with a resolution adopted by the Board of Regents of the College, plans are now under way to resume publication of the College Directory. Forms for a listing in the Directory have been mailed to every member of record in the College, and it is requested that these forms be completed and returned to the Executive Offices of the College at Chicago as soon as possible. If you have not received a form for listing in the 1946 College Directory, will you please write at once to the Executive Secretary for a copy of *Form F-25*.

EDITORIAL BOARD

"DISEASES OF THE CHEST"

The Board of Regents of the College, meeting at Cincinnati on November 11, 1945, elected Dr. Andrew L. Banyai, Milwaukee, Wisconsin; Dr. Jay Arthur Myers, Minneapolis, Minnesota; and Dr. Richard H. Overholt, Brookline, Massachusetts, to serve with Dr. Charles M. Hend-

ricks, El Paso, Texas, and Dr. Champ H. Holmes, Atlanta, Georgia, as members of the Editorial Board of "Diseases of the Chest." At a meeting of the Editorial Board, Dr. Jay Arthur Myers was unanimously elected to serve as Chairman of the Board and Editor-in-Chief of "Diseases of the Chest." He succeeds Dr. Ralph C. Matson, Portland, Oregon, *deceased*.

NEW COLLEGE GOVERNOR FOR MISSISSIPPI

Dr. Robert E. Schwartz, Hattiesburg, Mississippi, was elected Governor of the College for the state of Mississippi at the meeting of the Board of Regents held at Cincinnati on November 11. Dr. Schwartz succeeds Dr. John S. Harter, formerly of Jackson, Mississippi, who is now with the Hazelwood Sanatorium, Louisville, Kentucky.

College Chapter News

SOUTHERN CHAPTER

The following officers were elected at the annual meeting of the Southern Chapter of the College which met in conjunction with the Southern Medical Association at Cincinnati, Ohio, on November 12, 1945:

Carl C. Aven, M.D., F.C.C.P., Atlanta, Georgia, President.
Paul A. Turner, M.D., F.C.C.P., Louisville, Kentucky, First Vice-Pres.
Herbert L. Mantz, M.D., F.C.C.P., St. Louis, Missouri, Second Vice-Pres.
Benjamin L. Brock, M.D., F.C.C.P., Waverly Hills, Kentucky, Secretary-Treasurer (Re-elected).

The following resolution was presented at the meeting and unanimously adopted:

WHEREAS, there is a well defined field of medicine and surgery commonly known as "Diseases of the Chest," and

WHEREAS, the physicians who are engaged in this specialty practice both medical and surgical procedures, and

WHEREAS, none of the present constituted specialty boards have made ample provision for the certification of physicians and surgeons who are engaged in the specialty of chest diseases,

THEREFORE BE IT RESOLVED that the Southern Chapter of the American College of Chest Physicians, in annual session assembled at Cincinnati, Ohio, place itself on record as in favor of the following:

1. That the Board of Regents of the American College of Chest Physicians take whatever steps are necessary to sponsor the organization of a Board of Diseases of the Chest.
2. That this Board receive the same recognition which is accorded to all other specialty boards.

Dr. Alvis E. Greer, Houston, Texas, the outgoing president, presented an address at the annual dinner of the Chapter entitled "The College—Yesterday, Today and Tomorrow." Dr. Greer was introduced by Dr. Charles M. Hendricks, El Paso, Texas, the President-Elect of the American College of Chest Physicians.

The scientific program was presented under the chairmanship of Dr. Paul A. Turner and the meeting ended with an x-ray conference conducted by Dr. John M. Preston, Columbia, South Carolina.

Dr. Charles J. Farrell, Covington, Kentucky, Chairman of the Housing Committee of the Southern Chapter, efficiently handled the hotel accommodations.

Benjamin L. Brock, M.D.
Secretary-Treasurer.

College Governors Attend Meeting

The following Governors of the states which affiliate with the Southern Chapter of the College attended the Southern Chapter Meeting:

Dr. Merle D. Bonner, North Carolina
Dr. Benjamin L. Brock, Kentucky
Dr. R. Kyle Brown, South Carolina
Dr. Dean B. Cole, Virginia
Dr. Herbert L. Mantz, Missouri
Dr. Robert E. Schwartz, Mississippi

Dr. William A. Hudson, Detroit, Michigan, Chairman of the Board of Governors, attended the meeting, as well as Dr. John H. Skavlem, Cincinnati, Governor of the College for Ohio.

PACIFIC NORTHWEST DISTRICT CHAPTER

In January 1945, members of the American College of Chest Physicians organized a District Chapter of the College meeting at the Benson Hotel in Portland, Oregon.

On September 27 and 28, the Pacific Northwest States Chapter of the American College of Chest Physicians met again at The Dalles, Oregon. At this meeting it was decided that British Columbia, represented by Dr. Elliott Harrison, would be included in the Northwest District Chapter; it was recommended that the American Medical Association include Cardio-respiratory diseases as well as Tuberculosis in its classification of sub-specialties; and the Chapter went on record as favoring maximum use of existing facilities and of private care for returning war veterans to supplement Veterans Administration facilities and to obviate over-expansion of the latter.

It was decided that the next Chapter meeting be held in Vancouver, B. C., and the following officers were elected:

John E. Nelson, M.D., F.C.C.P., Seattle, Washington, President
Frank I. Terrill, M.D., F.C.C.P., Deer Lodge, Montana, Vice-President
Florence A. Brown, M.D., F.C.C.P., Portland, Oregon, Secretary-Treas.

After the business session the following scientific program was presented:

Scientific Meeting, Howard Lane Hull, M.D., F.C.C.P., Yakima, Washington, presiding.

"The Clinical Application of Paradrine Hydrobromide in Adams-Stokes Syndrome," Irvin R. Fox, M.D., F.C.C.P., Eugene, Oregon.

Discussion by John F. Steele, M.D., F.C.C.P., Seattle, Washington.

"Adenoma of the Bronchus," William B. Hutchinson, M.D., Seattle, Wash.

Discussion by Paul K. Lund, M.D., Seattle, Washington.

"Pulmonary Resection for Pulmonary Tuberculosis," James Pomeroy, M.D., Portland, Oregon.

Discussion by James Odell, M.D., F.C.C.P., The Dalles, Oregon.

Lunch—Frederick Slyfield, M.D., F.C.C.P., Seattle, Washington, presiding.

"Fungus Diseases of the Lung," Lt. Comdr. Gevurtz, MC, F.C.C.P., Bremerton, Washington.

Discussion by James Odell, M.D., F.C.C.P., The Dalles, Oregon.

"Blood Sedimentation Rate as an Index in the Treatment of Pulmonary Tuberculosis," James Odell, M.D., F.C.C.P., The Dalles, Oregon.

Discussion by John Srail, M.D., F.C.C.P., Elma, Washington.

"City County Tuberculosis Survey in Portland: Findings and Follow-up of First Year," Florence Brown, M.D., F.C.C.P., Portland, Oregon.

Discussion by Cedric Northrop, M.D., Seattle, Washington.

Banquet—Elliott Harrison, M.D., F.C.C.P., Vancouver, B. C., presiding.

"Bronchogenic Carcinoma," William Conklin, M.D., F.C.C.P., Portland, Oregon.

Discussion by William B. Hutchinson, M.D., Seattle, Washington.

"The Chest Man Should Know the Heart," Frederick Slyfield, M.D., F.C.C.P., Seattle, Washington.

Discussion by Howard Lane Hull, M.D., F.C.C.P., Yakima, Washington.

"Removal of Foreign Bodies in the Bronchus or Esophagus," Frank Terrill, M.D., F.C.C.P., Deer Lodge, Montana.

Discussion by William Conklin, M.D., F.C.C.P., Portland, Oregon.

Lunch—Kenneth Tyler, M.D., Deer Lodge, Montana, presiding.

Case Presentations, Eastern Oregon State Tuberculosis Hospital, James M. Odell, M.D., F.C.C.P., The Dalles, Oregon.

William S. Conklin, M.D.
Secretary-Treasurer.

NEW JERSEY CHAPTER

On November 20, 1945, the New Jersey Chapter of the American College of Chest Physicians held a joint meeting with the Passaic County Medical Society at the Valley View Sanatorium in Paterson, New Jersey.

Paul Geary, M.D., F.C.C.P., Plainfield, was the main speaker, his subject being "The Surgical Treatment of Lung Diseases." Dr. Geary's talk was illustrated with many lantern slides and x-ray films. Irving Willner, M.D., F.C.C.P., Newark, opened the discussion.

Stephen A. Douglass, M.D., F.C.C.P., President of the Chapter, was host at a dinner following the program.

Harold S. Hatch, M.D.
Secretary-Treasurer.

MICHIGAN CHAPTER

The Michigan Chapter held a meeting at the Fort Shelby Hotel, Detroit, on December 1. Dr. William A. Hudson, Chairman of the Board of Governors of the College, reported on the progress of the Governors in this country regarding their activities in their respective states pertaining to the College program. The Governors of the College are actively supporting the formation of a Board of Diseases of the Chest. The meeting was closed with an excellent x-ray conference in which all of the members present participated.

William P. Chester, M.D.
Secretary-Treasurer.

ILLINOIS CHAPTER

A joint meeting of the Chicago Tuberculosis Society and the Illinois Chapter of the College was held at the Stevens Hotel, Chicago, on December 6, 1945. Dr. Oscar T. Clagett, Mayo Clinic, Rochester, Minnesota, was the guest speaker and presented a paper on "Pulmonary Resection for Tuberculosis." The paper was discussed by Drs. W. E. Adams, Richard Davison, Jerome Head and Willard Van Hazel, Chicago, Illinois. Dr. Hugo Deuss, President of the Chicago Tuberculosis Society presided at the meeting. The following new officers were elected for the Chicago Tuberculosis Society:

Jacob J. Mendelsohn, M.D., F.C.C.P., Chicago, President.

Arthur S. Webb, M.D., F.C.C.P., Glen Ellyn, Vice-President.

Hugo C. Cutrera, M.D., F.C.C.P., Chicago, Secretary-Treasurer (Re-elected)

The Illinois Chapter of the College will hold its annual meeting in connection with the annual meeting of the Illinois State Medical Society at Chicago, May 14-16, 1946. Dr. Kenneth G. Bulley, Aurora, the Chairman of the Scientific Program Committee, is arranging the program for the meeting.

Arthur S. Webb, M.D.
Secretary-Treasurer.

Meeting of Committee on Medical Education

A meeting of the Committee on Medical Education of the Illinois Chapter was held at the Executive Offices of the College in Chicago on November 24, 1945. A tentative schedule for postgraduate medical education in diseases of the chest, which was presented by the Committee to the Board of Regents of the College at Cincinnati, Ohio on November 11, was reviewed and discussed. Additional recommendations for improving the proposed course were discussed by the members of the committee and a revised schedule is being prepared. The Committee plans to organize this initial postgraduate course in the specialty of diseases of the chest in Chicago at an early date and it is hoped that this will be a fore-runner of similar postgraduate courses on chest diseases to be held in other sections of the country.

Edwin R. Levine, M.D., *Chairman*
Paul H. Holinger, M.D.
Minas Joannides, M.D.

NEW YORK STATE CHAPTER

The New York State Chapter of the College will hold its Annual Meeting at the Hotel Pennsylvania, New York City on May 2, 1946. For further particulars concerning the meeting communicate with Dr. Nelson W. Strohm, Buffalo, N. Y., Regent of the College for the District.

Arthur Q. Penta, M.D., F.C.C.P.
Secretary-Treasurer.

ANNOUNCEMENT

Physicians who wish to present papers at the annual meeting of the College are requested to mail abstracts of their papers to the Scientific Program Committee.

Dr. Minas Joannides, Chicago, Ill., *Chairman*
Major General S. U. Marietta, Washington, D. C.
Colonel John B. Grow, Denver, Colorado.

ARGENTINE CHAPTER

Because of internal conditions in Argentina, the annual meeting of the Argentine Chapter of the College for 1945 was suspended. This action was taken by all cultural, scientific and medical societies.

The following applications for Associate Membership in the College were submitted by the Argentine Chapter:

Dr. Agustín Jorge Alvarez, Buenos Aires
Dr. Jose Bellinzi, La Plata
Dr. Francisco R. D'Ovidio, La Plata
Dr. Paulino Andres Rojas, La Plata
Dr. Alberto Jose Soubrie, Buenos Aires

Juan Carlos Rey, M.D.
Secretary-Treasurer

P E R U

Peru will be host to the Seventh Congress of the Union of Latin American Tuberculosis Societies at Lima, January 1947. Prof. Ovidio Garcia Rosell, Governor of the College for Peru is the President of the Congress. The members of the Peruvian Chapter of the College will take a leading part in the arrangements for the Congress. Fellows of the College from all of the countries in South, Central and North America will participate in the Scientific Program. Delegates from all countries in the Western Hemisphere will attend the Congress which is sponsored by ULAST.

URUGUAY

The Quarterly Course on the treatment of pulmonary tuberculosis will be given under the direction of Prof. Dr. Fernando D. Gomez, F.C.C.P., Faculty of Medicine, at the Instituto de Tisiologia (Prof. Juan B. Morelli), Montevideo, on March 18-30, 1946. The Sub-Director of the course is Dr. Pablo Purriel, F.C.C.P. It will be given as a theoretical and practical course on the treatment of pulmonary tuberculosis. In addition to the members of the Institute, the following prominent physicians will participate in presenting the course:

Dr. A. Alonso Vial, Dr. Jose Bado, Dr. Pedro A. Barcia, Dr. Juan C. Etcheverry, Dr. Camilo Fabini, Dr. Julio C. Garcia Otero, Dr. Filisberto Gomez Ferrer, Dr. Hector Orrego Puelma, F.C.C.P., and Dr. Abelardo Saenz, F.C.C.P.

For further information concerning the course, please communicate with "La Secretaria del Instituto de Tisiologia, Hospital Fermin Ferreira, Pabellon XVII, Avda. Larranaga, 1380, Montevideo, Uruguay."

ANNOUNCEMENT

Nominations for officers to be elected at the Twelfth Annual Meeting of the College to be held at San Francisco, California, June 29-30, July 1-2, 1946, are to be mailed to the Nominating Committee.

Dr. Harry C. Warren, San Francisco, Calif., *Chairman*
Dr. Benjamin L. Brock, Waverly Hills, Kentucky
Dr. Irving Willner, Newark, New Jersey.

Positions Wanted and Available

POSITIONS WANTED

Chest specialist of Polish nationality, attached to the Royal Air Force in Great Britain and soon to be demobilized, desires to work in an American clinic or sanatorium. Speaks and writes English fluently. Experienced in sanatorium work; completed course in tuberculosis and diseases of the chest in Rome. For further particulars address Box 219A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Medical Directorship desired by Fellow of the American College of Chest Physicians, which would afford a good medical opportunity for full time clinical work in tuberculosis and chest diseases. Fully experienced. For further particulars please address Box 220A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Physician recently released from service desires part time position with facilities for establishing private practice, anywhere in U. S. A. For further particulars please address Box 221A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Physician recently released from the army desires sanatorium position. Experienced in sanatorium work; Fellow of the American College of Chest Physicians. For further particulars please address Box 222A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Chest specialist recently released from the service desires sanatorium position, preferably in California, New Mexico, or Arizona. Has specialized in tuberculosis work for past thirteen years. For further information please address Box 223A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Physician, well trained and experienced in all phases of tuberculosis desires position as medical director in a 200-300 bed sanatorium. Minimum salary \$4,500 with complete maintenance. For further particulars please address Box 209A, American College of Chest Physicians, 500 N. Dearborn St., Chicago 10, Illinois.

Physician recently released from service desires part time position in private practice in or near Chicago. Would consider residency in approved hospital. For further particulars address Box 210A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Physician recently released from service desires residency in an approved hospital or part time position in private practice. For further particulars address Box 211A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Physician recently released from service would like position in institution or private clinic. Experienced in treatment of tuberculosis and other chest diseases. Good references. For further particulars address Box 213A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Part time position in or near Chicago wanted by physician recently released from service. Qualified for Boards. For further particulars address Box 214A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

Wanted, position in chest surgery in the west or southwest. Veteran, 2 years thoracic surgical training, license in the State of Illinois. For further particulars, address Box 212A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Experienced thoracic surgeon and bronchoscopist desires position in sanatorium or with private medical group, either full or part time. For further particulars address Box 215A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Physician being released from service desires position with a progressive institution. Experienced in tuberculosis field. For further information please address Box 218A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Part time position in or near Chicago wanted by physician recently released from service. Is establishing private practice; has spent some time in chest work. For further particulars please address Box 216A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.

POSITIONS AVAILABLE

Resident physician wanted for state tuberculosis hospital in northwest. Salary, \$275.00 per month with complete maintenance. For further particulars, please address Box 126A, American College of Chest Physicians, 500 North Dearborn St., Chicago 10, Illinois.